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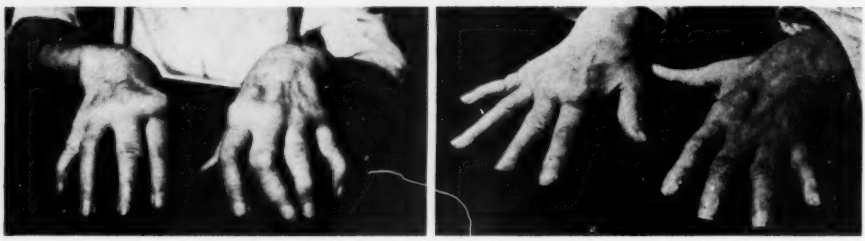

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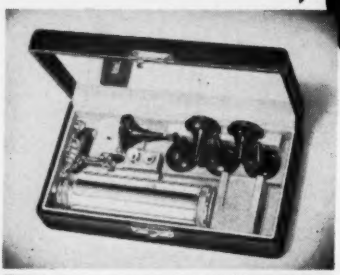

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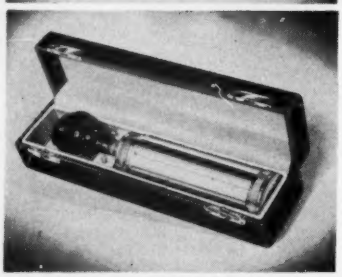

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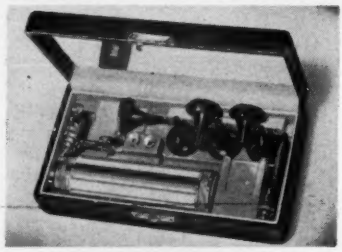

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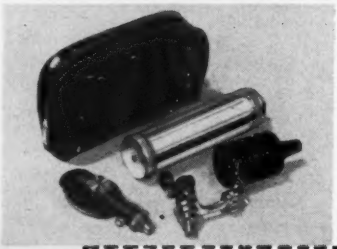

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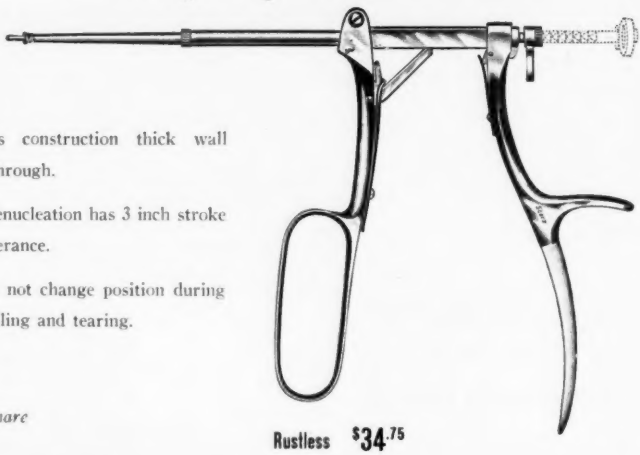

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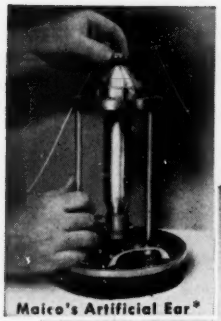

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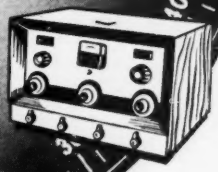

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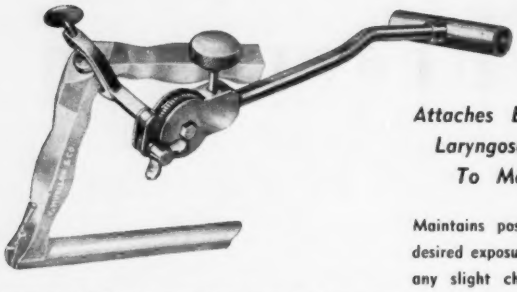

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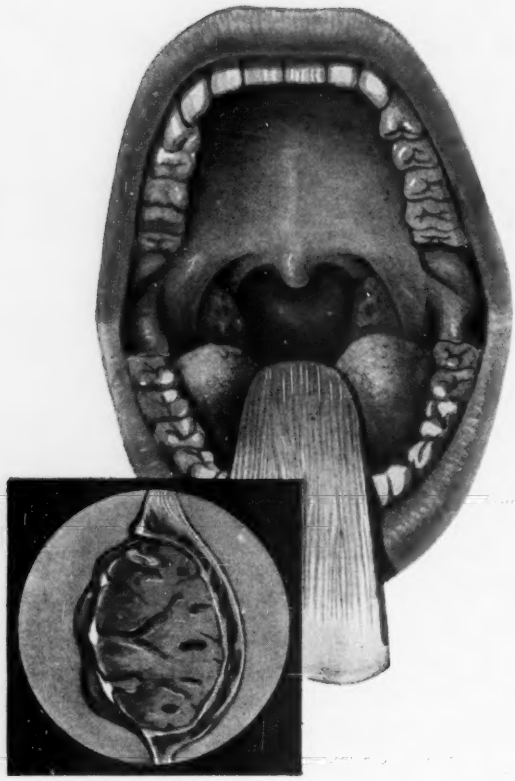

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ENDOSCOPIC REMOVAL OF LIPOMA OF THE BRONCHUS

Report of Two Cases

MAX L. SOM, M.D.
AND
SIDNEY S. FEUERSTEIN, M.D.
NEW YORK

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The majority of these lipomas were located in the main-stem bronchi and the remaining few in the branch bronchi. No case of multiple bronchial lipomas has been reported, nor any of lipomas that originated in the trachea. Seven of the eight

From the Otolaryngological Service of the Beth Israel Hospital.

Read before the Section on Otolaryngology of The New York Academy of Medicine, May 17, 1950.

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cases in which endoscopic treatment was given were of men and one was of a woman. The ages of these patients varied from 29 to 61 years, the average being 49 years.

Viewed through the bronchoscope, these tumors appear as semifirm, rounded masses, with an intact mucous membrane. They are usually pedunculated and hence freely movable. Their color is distinctly a paler pink than that of the bronchial adenoma. The size of the lipoma is necessarily restricted to the caliber of the bronchial lumen to which it is confined. Nevertheless, some have been described as attaining a length of 5 cm.

The nonmalignant character of these tumors is attested by the fact that they either are pedunculated or have only a limited attachment to the bronchial wall and never metastasize. Histologically, the cells are of uniform character and are composed primarily of mature fat cells interspersed with fibrous connective tissue. No case of malignant degeneration of a bronchial lipoma has been reported.

The pathogenesis is not definitely known. Watts [7] has shown that fat is a normal constituent of the bronchi and exists wherever cartilage is found. He concluded that lipomas probably arise from submucosal fat, possibly from islands of fetal mesodermal fat cells which lie dormant in the bronchus.

The symptoms of these tumors are due to the sequelae of partial or complete bronchial obstruction or surface erosion. The earliest of these symptoms, caused by narrowing of the bronchial lumen, is the audible wheeze. As the polypoid tumor increases in size, the so-called check-valve mechanism of bronchial obstruction comes into play and is manifested by bronchial occlusion in the expiratory phase. This mechanism results in pulmonary emphysema distal to the obstruction. Mediastinal shift to the opposite side will be noted on expiration. When the bronchial lumen becomes completely occluded in both phases of respiration, pulmonary atelectasis may ensue in that portion of the lung distal to the tumor. The mediastinum then shifts to the side of the lesion on inspiration.

Concomitant with marked bronchial obstruction, effective ciliary function of the distal segments is seriously impaired. This results in stasis of the secretions and subsequent infection which may lead to pulmonary abscess, recurrent pneumonias, bronchiectasis, pleurisy, or empyema. Incidentally, hemoptysis, which is an early complaint in adenoma, is a late symptom in lipoma and is usually secondary to bronchial infection distal to the obstruction.

REPORT OF CASES

CASE 1.—N. K. was a 55-year-old white man admitted to the Beth Israel Hospital in October, 1948, with complaints of persistent cough, pain in the chest, and intermittent fever. He had had recurrent bouts of hemoptysis for some 15 years. The bleeding was never profuse. Physical examination two years prior to the present admission was said to have revealed diminished resonance and limited expansion of the right side of the chest, with distant breath sounds posteriorly. Recently, he had had several bouts of chills and fever associated with pain in the right side of the chest.

Roentgen examination of his chest a week prior to admission showed multiple areas of infiltration in the lower lobe of the right lung, with a shift of the mediastinum to the right and some elevation of the diaphragm on the same side (Fig. 1).

On Oct. 6, 1948, bronchoscopy was performed with use of local anesthesia, and a large, smooth tumor obliterating the right main bronchus could be seen at the level of the right

middle lobe bronchus. The bulbous proximal portion was covered by an intact mucous membrane. The distal attachment, by a pedicle, proved to be in the right lower lobe just below its apical branch. The bronchus appeared somewhat dilated. Distal to the tumor a recurring purulent secretion was aspirated. A bronchoscopic specimen was taken from the proximal surface of the mass. The tissue was unusually fibrous and was cut with difficulty. The biopsy specimen was reported as lipoma of the bronchus.

Twelve days following the initial endoscopy, bronchoscopy was again performed, with the view of removing the mass *in toto*. The pedicle of the tumor, which was located in the right lower-lobe bronchus, was grasped with a forceps, and with firm pressure the tumor was avulsed en masse.

Grossly, the removed tumor was more or less club-shaped and measured 2 by 1.5 cm. (Fig. 2). Its surface was smooth and pale pink on the proximal side and a distinct yellow on the distal aspect. Microscopically, the neoplasm was covered by an intact mucous membrane, with a narrow hyaline zone under it. There were no proliferative changes in the epithelium. The underlying stroma consisted, primarily, of fat cells which were compact and somewhat granular. There were occasional aggregations of lymphocytes in the dermis (Fig. 3).

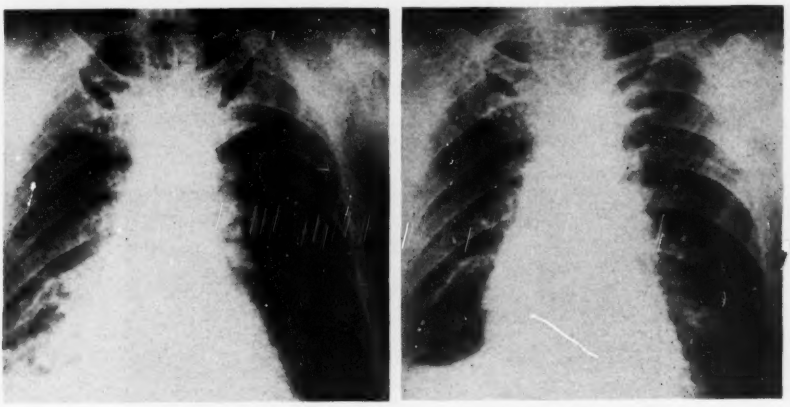

Fig. 1 (Case 1).—Left, roentgenogram of chest on admission, showing multiple areas of infiltration in the lower lobe of the right lung. Right, repeat roentgenogram five months after bronchoscopic removal of lipoma, showing increased aeration of lower lobe of right lung.

The patient has remained symptom-free for the past two and one half years, although roentgenograms of the chest still show slight streaking in the right lower lung field (Fig. 1 [right]). Undoubtedly, there remain small areas of residual infection in the distal segments of the lower lobe of the right lung which are of no clinical significance. The patient is free of cough and conducts a normal, active life without any limitations. There has been no further hemoptysis, fever, or chest pain. Bronchoscopy fails to reveal any evidence of recurrence of the lipoma.

Case 2.—J. B. was a 59-year-old white man admitted to Beth Israel Hospital on Jan. 5, 1950, with the complaint of painless hemoptysis of two days' duration. For several years, he had been troubled by a spasmodic cough which occasionally was productive of yellow sputum. During the two months prior to admission, the sputum was slightly flecked with blood.

Physical examination of the chest revealed diminished breath sounds associated with audible low-pitched rhonchi over the upper lobe of the right lung posteriorly. Fluoroscope and roentgenographic examinations of the lungs revealed atelectasis of the anterior segment of the right upper lobe. There was also a moderate mediastinal shift to the right (Fig. 4 [left]).

On Jan. 9, 1950, bronchoscopy was performed, and a semifirm, smooth, movable, and nodular tumor presenting at the orifice of the right upper lobe bronchus was noted. It was firmly attached by a pedicle to the spur of the right upper lobe bronchus and was avulsed with a grasping forceps.

Fig. 2 (Case 1).—Photograph of mass removed endoscopically from right lower lobe bronchus. The smooth surface can be recognized, and the narrowed pedicle is apparent.

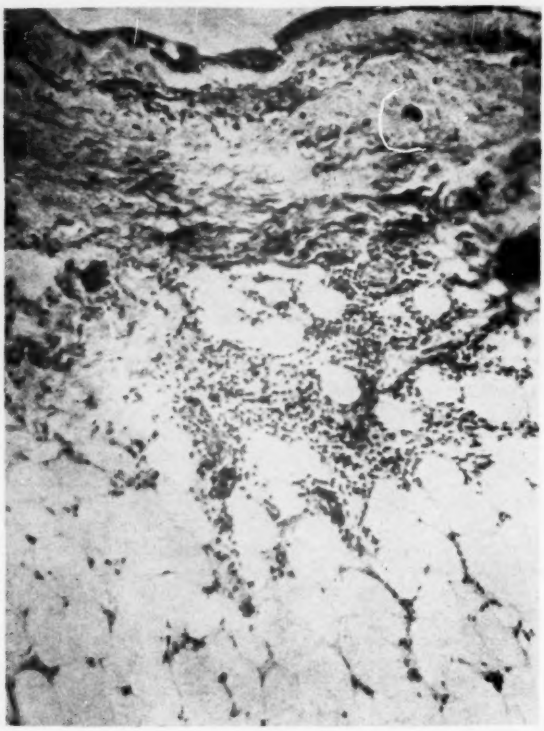

Fig. 3 (Case 1).—Photomicrograph of section through surface area of tissue specimen. The predominance of lipid cellular elements in stroma can be seen submucosally.

Grossly, the tumor was triangular, measuring 2.3 cm. in length, 1.8 cm. in width, and 1 cm. in thickness. At the broader distal end of the specimen, there were distinct markings which subdivided the mass into three somewhat lobular structures (Fig. 5). The mass was soft, and

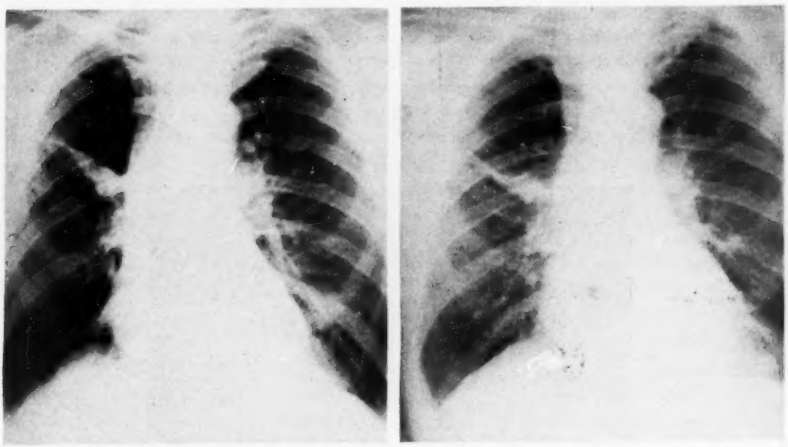

Fig. 4 (Case 2).—Left, roentgenogram of chest on admission, showing partial atelectasis of upper lobe of right lung and moderate mediastinal shift to right. Right, repeat chest roentgenogram, made five months after bronchoscopic removal of the tumor, shows re-expansion of the upper lobe of the right lung, with some residual atelectasis and disappearance of the obstructive emphysema.

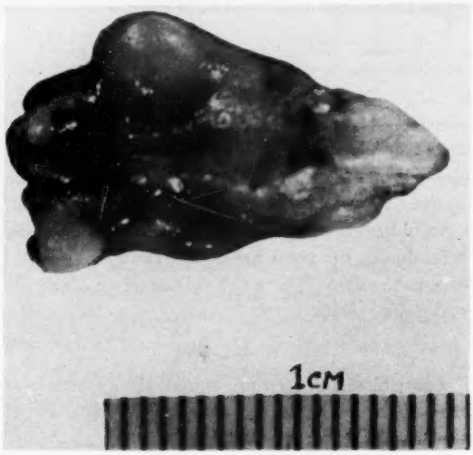

Fig. 5 (Case 2).—Photograph of lipoma removed endoscopically, showing the trilobular distal structure of the tumor. Each one of these prominences corresponds to a branch of the right upper lobe bronchus.

glistening, and, except for some small areas of cartilage at the trilobate end, had a distinct yellowish color.

Microscopically, the specimen was covered with respiratory epithelium. An occasional small area of metaplasia to stratified squamous epithelium was noted. The major portion consisted of

adipose tissue, but there were a few small areas of cartilage formation at the periphery. No epithelial structures were found within the mass (Fig. 6).

Postoperatively, all symptoms and signs of obstruction and infection of the right upper lobe bronchus subsided. Roentgen examination of the chest 10 days later revealed return of the mediastinum to the midline and reaeration of the segments of the upper lobe of the right lung. However, there remained a streak of segmental atelectasis which probably was due to irreversible fibrosis of the involved lobar segment (Fig. 4 [left]).

Follow-up bronchoscopy was performed on April 3, 1950, and the right upper lobe bronchus was noted to be widely patent, with no evidence of residual tumor.

Clinically, to date, this patient has been asymptomatic, with complete loss of his chronic cough and hemoptysis.

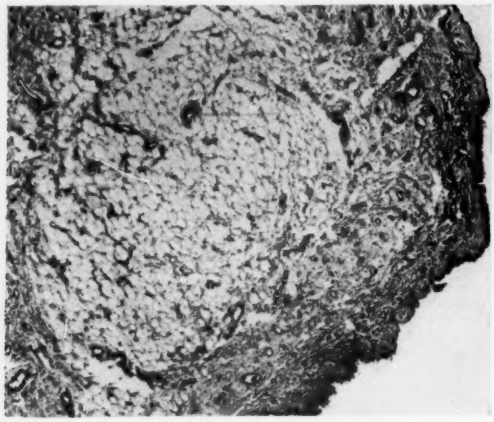

Fig. 6 (Case 2).—Low-power photomicrograph of tumor in Figure 5, showing predominance of lipid tissue with overlying respiratory epithelium.

CONCLUSIONS

These cases again emphasize the fact that even after long-standing infection on the basis of bronchial obstruction, marked improvement and restitution to normal can be expected in the affected lobe if the patency of the bronchus is re-established. Certainly, there is no indication, at present, for lobectomy in this particular instance, since symptoms referable to the chest are few. However, lipomas do occur in lung parenchyma, such as in the cases reported by Touroff and Seley [11] in which extirpation of the lung was required for cure.

SUMMARY

Two cases of pedunculated benign lipomas of the bronchus are presented. One patient had a history of recurrent pneumonias for 15 years, and the other, a chronic cough for several years. Both had hemoptysis.

Roentgenograms of the chest were indicative of bronchial obstruction with atelectasis and infection.

In both patients pedunculated neoplasms were removed endoscopically, and the patients have remained symptom-free to this date.

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OBSERVATIONS ON ANATOMY OF THE TYMPANIC PLEXUS AND TECHNIQUE OF TYMPANOSYMPATHECTOMY

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SINCE Lempert presented his observations concerning the tympanic plexus and its functional importance and his experience regarding the effect of tympanosympathectomy, this subject has been the object of an ever-increasing general interest. A number of surgeons have attempted the operation under different pathologic conditions. To be sure, some successful cases could be recorded, but nevertheless, on the whole, their conclusions are rather pessimistic. For my part, I consider that something of value could very well be hidden within the theories presented by Lempert, especially if the possibility of a connection between two different phylogenetic sound systems is admitted, as Samuel Rosen points out.

Without ascribing a positive significance to the tympanic plexus in the origin of tinnitus, I have, however, adopted Lempert's idea as a working hypothesis and performed tympanosympathectomy for a large number of conditions, among them Ménière's disease and otosclerosis.

In order to explain my own point of view and my own experiences concerning the importance of plexus tympanicus in cases of tinnitus I wish to present some established facts about the anatomy of the plexus and some viewpoints on its operative treatment.

As far as I have seen and heard described, tympanosympathectomy is performed so that the promontory is scraped clean with different instruments. One starts with the assumption, then, that the tympanic nerve and its branches lie in open grooves on the surface of the promontory, but does not expect that sometimes the main nerve or its anastomoses, which may be important, might lie hidden in bony canals. In all textbooks it is stated that the plexus tympanicus runs over the promontory in grooved depressions on the bony surface. If such were the case, a simple scraping clean would be sufficient. Upon closer study of the anatomy, however, it may be seen that large parts of the nerve and plexus run in covered bony canals and very irregularly. During the operation, this may be easily demonstrated with enlargement, preferably by a microscope with a 10-diameter magnification or, after staining, by the Zeiss magnifying glasses. On the whole, it may be said that the variations are such that in some cases the nerve passes the entire way in an open sulcus, in others entirely in closed canals, and in still others partially uncovered and partially covered by a thin bony shell. The drawings (Figs. 1 and 2) from operations and sections from excised and sectioned temporal bones present examples of a number of variations. The sketches from operations are by one of my associates, Dr. Ludin.

The pictures show the unstained medial wall of the middle ear during operation. In the first series the nerves are seen completely uncovered in open grooves. This is followed by preparations showing the lower extension of the nerve in a

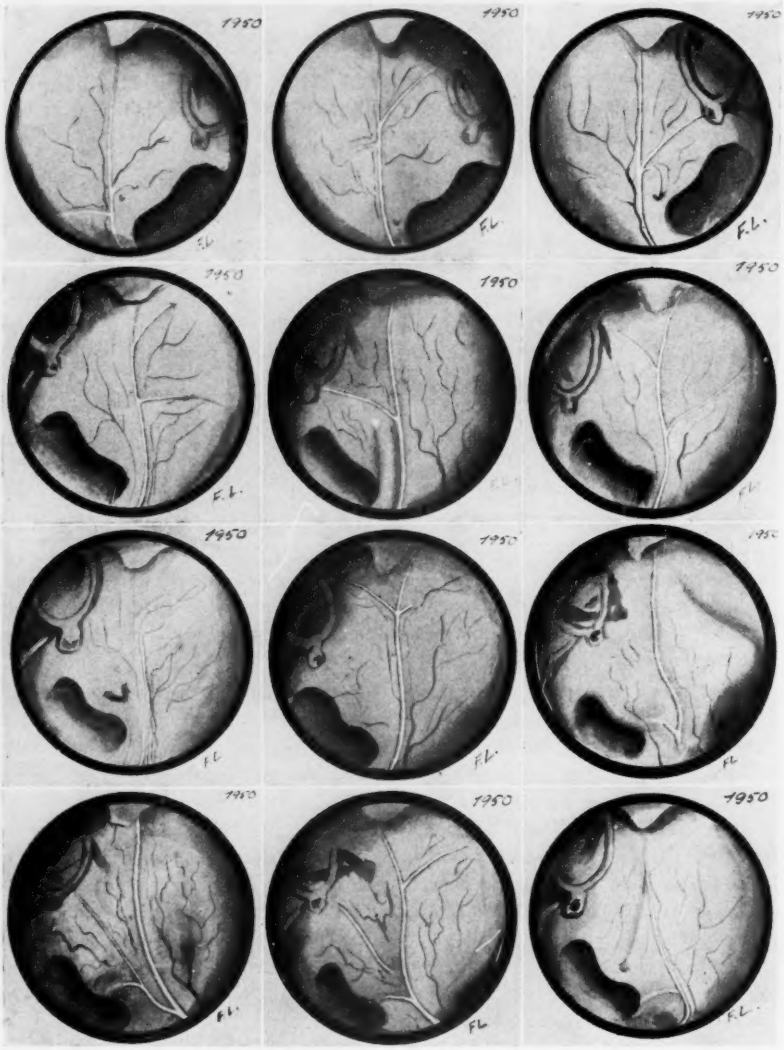

Fig. 1.—The medial wall of the middle ear (unstained) during operation. Examples of a number of variations are shown.

canal; the next series shows the upper portion and then a smaller part of the lower as well as the upper portion covered. Finally the entire nerve is seen to be in a closed canal.

These drawings do not exhibit especially large variations in the course and branching of the tympanic plexus over the promontory. This is because, although

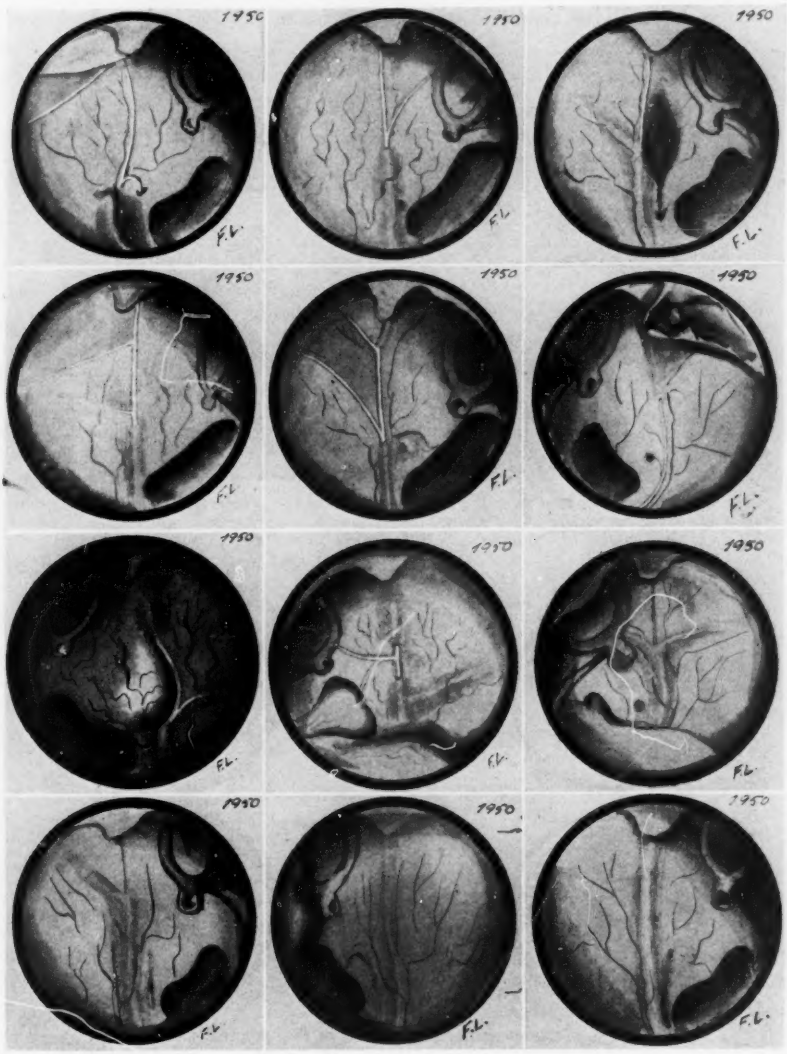

Fig. 2.—The medial wall of the middle ear (unstained) during operation. Examples of a number of variations are shown.

it is true that a quantity of fiber-like formations in the mucous membrane which might be suspected of being nerve branches could be observed with a 10-diameter magnification without staining the nerve, the kind of fiber could not be definitely

determined at the operation performed. Therefore, only those fibers which could be microscopically verified after removal as being nerves have been drawn.

In order to verify the observations I made during operations, it appeared necessary to study the course of the nerve microscopically on cadaver specimens

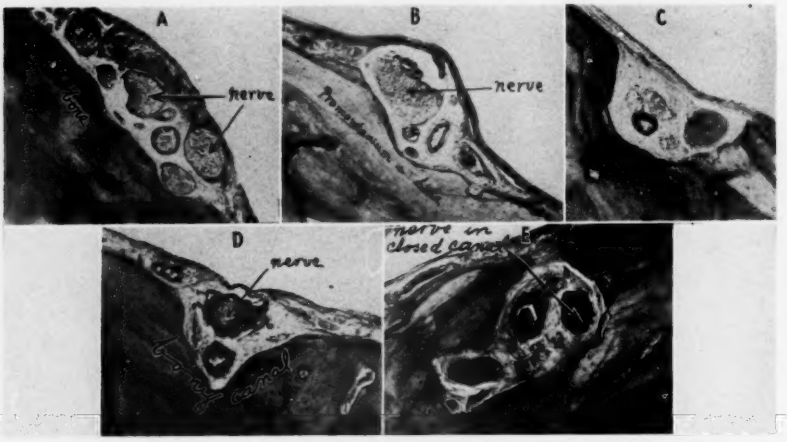

Fig. 3.—*A*, the nerve runs over the smooth surface of the promontory. *B*, shallow groove from which the nerve may be easily scraped out. *C* and *D*, deeper groove which offers a certain difficulty in the removal of the nerve. *E*, almost closed canal which must be opened in order to take out the nerve.

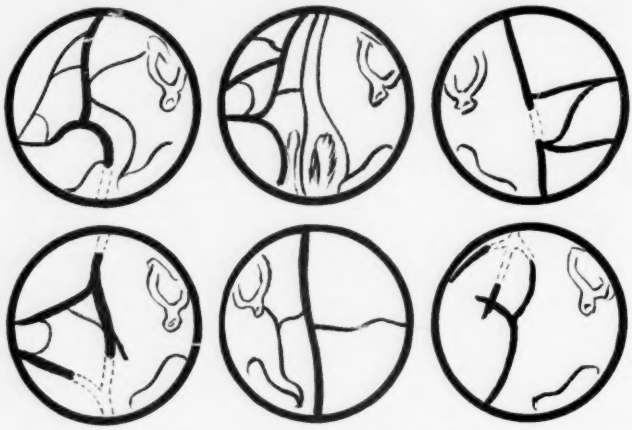

Fig. 4.—Osmium-stained preparations of the tympanic plexus.

also. Through Dr. Hans Engström, who studied the histology of the inner ear, especially in cases of otosclerosis, I have been able to select suitable preparations from his collection and have obtained his expert opinion on them. Their extremely varied anatomic appearance confirms the operative findings concerning the course; some are in closed canals, some are in open furrows. The course of the main stem

and of the branches on the promontory is never the same in two cases. The variations shown in Figure 3 are presented as examples.

The important variations of the nerve as to course, branching, and anastomoses may also be demonstrated in the preceding collection of preparations but are even better shown on osmium-stained preparations, such as those shown in Figure 4 made by Dr. Engström.

As it proved possible, through careful application of osmium tetroxide to the promontory of a living human patient during operation, to obtain an excellent staining of the plexus without injury to the patient, I have applied this method which offers a number of advantages in about 50 cases. The branching of the

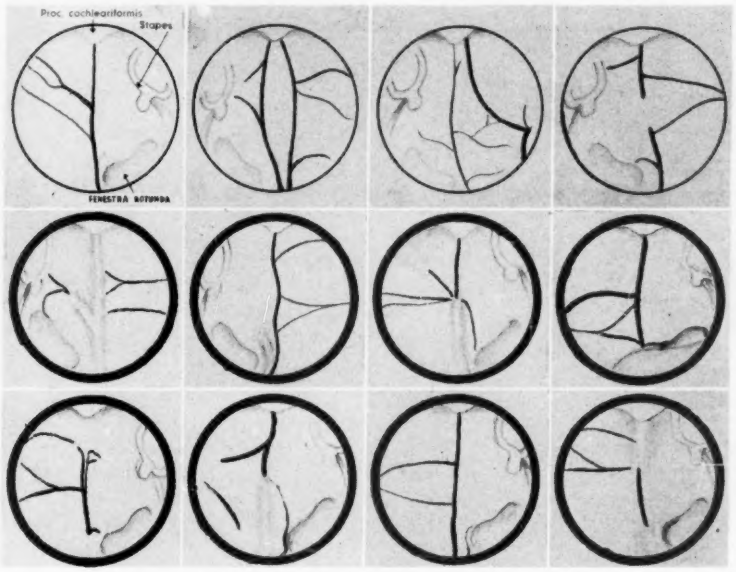

Fig. 5.—Tympanic plexus with vital staining.

plexus and its course in grooves or canals can be immediately determined. The technical procedure in tympanosympathectomy is considerably facilitated. With the aid of the microscope, it can be ascertained which branches are and which are not medullated. Each branch can be individually removed for microscopic examination. The risk of overlooking anastomoses which should be removed is reduced to a minimum.

Figures 5 and 6 show examples of the varying appearance of the tympanic plexus stained during operation.

The branches mentioned in textbooks reappear more or less consistently, but the variations are considerably greater than indicated therein. This is true of the alternating course in closed canals or open grooves, as well as of the branching of the different nerves or dividing into several parts. It is not unusual that the

main nerve, the tympanic, is divided into two or more trunks, generally with rather parallel courses. The same is true of both the superior and the inferior caroticotympanic nerves. Ramus anastomoticus vestibularis is the most inconstant branch. Ramus anastomoticus acusticus, which may be suspected of having especially great significance in tinnitus, has commanded particular interest. Even before the staining method began to be applied, a little branch could be observed in the majority of cases, which ran backward at an acute or right angle from various parts of the tympanic nerve toward the anterior part of the fenestra rotunda and disappeared there in a funnel-shaped depression almost invisible to the naked eye. When this was instrumentally cleaned out, a microscopic hemorrhage in the opening usually resulted, indicating that a minute blood vessel also disappeared into the depression.

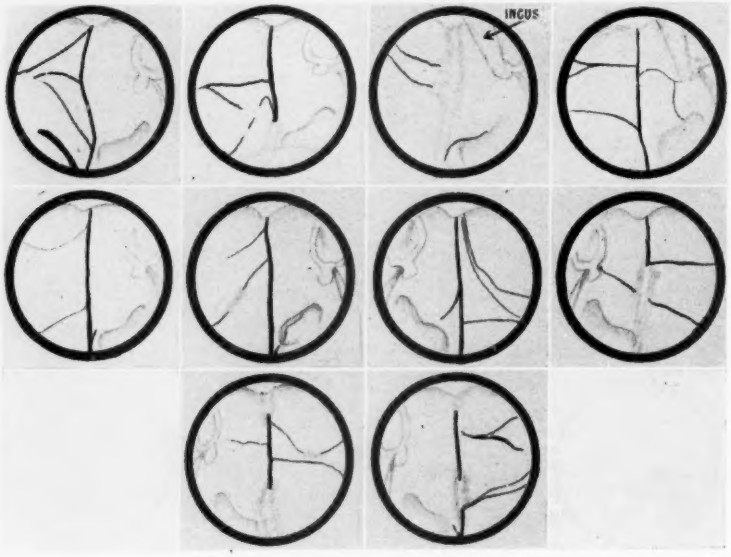

Fig. 6.—Tympanic plexus with vital staining.

In most cases, this branch has been shown with osmium staining; however, it does not become as blue-black as the rest of the branches but rather a more gray-brown, indicating a decrease in or absence of myelin. In a number of cases, only a questionable, extremely fine fiber could be found, but the subsequent histological examination has verified the presence of nerve tissue in that fiber. It seems as if this branch might be suspected of connecting the plexus with the acoustic nerve.

The variations in the appearance of the plexus seem endless. It is possible that a certain grouping of different types is conceivable; but, in order to achieve any sort of dependability in such a classification, a very great deal of material is necessary. Moreover, inasmuch as differentiation between medullated and nonmedullated fibers should be taken into consideration, classification will not be attempted until later in a more histological-anatomic work.

It is clear from the foregoing figures that in many cases a complete tympanosympathectomy is not done through the removal of the mucous membrane and the visible nerves on the surface of the promontory alone. It is also necessary to open the closed canals and carefully clean out their contents as far downward and upward as possible in order to remove possible anastomoses. Special attention has been given the millimeter-wide surface between the recess of the fenestra rotunda and the sulcus of the tympanic nerve in order to find the minute nerve suspected of being the ramus anastomoticus acusticus and the aforementioned funnel-shaped depression.

In all the patients on whom I performed tympanosympathectomy, the preceding radical curettage of the plexus has been carried out, and I hope, therefore, to be able to contribute eventually to the decision as to whether or not this operation has significance in the abatement of tinnitus.

The technical procedure in tympanosympathectomy has been described by Lempert in 1946 and later also by Rosen and many others. On the basis of the aforementioned anatomic conditions, I consider that all visible and suspicious nerve branches must be sought out and cleaned out in order to prevent the conveying of impulses from one nerve region to another.

The medial wall in the middle ear is thoroughly exposed for inspection and made accessible to instruments. The lower part of the drum membrane is mobilized through separation of annular ring from its attachment. The lateral wall of the hypotympanum, including the concealing bony wall at the site of the emergence of the corda tympani nerve and the area around the stapedius muscle tendon, is scraped clean with a curette so that the promontory, the entire hypotympanum, and the fenestra rotunda are clearly visible and accessible. Caution should be observed herewith, however, so that a bulb of the jugular vein protruding into the hypotympanum is not injured. In operations thus far, I have observed a completely uncovered bulb in one case as well as several cases in which it lay, shimmering and blue, under a paper-thin bone shell. In cases of otosclerosis, or otherwise if the malleus and incus are removed, the tensor tympani tendon is also cut, whereby the tympanic membrane is mobilized and may be displaced upward and forward, affording considerably better exposition of the medial wall of the tympanic cavity.

As a rule, after this exposition, it is possible to see the main trunk in the tympanic, plexus and usually the larger branches also with a 2.5-diameter magnification. Vision is greatly facilitated, however, by osmium staining. In order to protect the fenestra region from surplus osmium solution, a short but thick cotton thread or a little bit of gauze tampon is placed in the hypotympanic valley, covering the fenestra rotunda. Thereafter, a few drops of osmium tetroxide solution is applied on the promontory. After two or three minutes, the solution and tampon are removed, and it can be observed that the plexus gradually takes on a blue-black color in the parts which lie exposed on the surface. When the nerves disappear in closed canals, no stained nerve whatsoever can be seen or, if the bony covering is extremely thin, there is a blue shimmering streak. At times, branching or curved connections between branches appear which are entirely stained slightly gray or gray-brown. These are assumed to be nonmedullated or only slightly medullated fibers of sympathetic origin. Their kind, which is difficult to determine in living material, will be investigated in greater detail in microscopic preparations.

After staining is completed, the different branches are individually removed for microscopic examination. This is done to permit both inspection of nerve tissue and determination of whether or not calcium deposits are present in the perineural connective tissue, concerning which a more detailed account will be given in another connection. Exposition of the parts of the nerve which lie in open grooves is a simple procedure with a magnifying glass. Even the parts which are covered by a thin bony lamella can be exposed without difficulty. On the other hand, certain technical inconvenience may be afforded, and, above all, at first it may seem unpleasant to open a deep canal in the wall of the promontory of which the thickness is not definitely known. To perform complete tympanosympathectomy, however, radical extirpation is essential. The canals

are expediently opened with needle-like hooks of different curvatures; with Lempert's angled raspatories which should, however, be reduced to half their width, and with small, specially constructed curettes of 0.25 to 0.3 mm. in diameter.

Naturally, it is necessary to keep in mind during the entire course of the operation that one is working in an area with many risk factors and with minute, extremely sensitive organs which may be easily damaged, e. g., the fenestra ovalis and the fenestra rotunda, the ossicle chain, the bulb of the jugular vein, and the

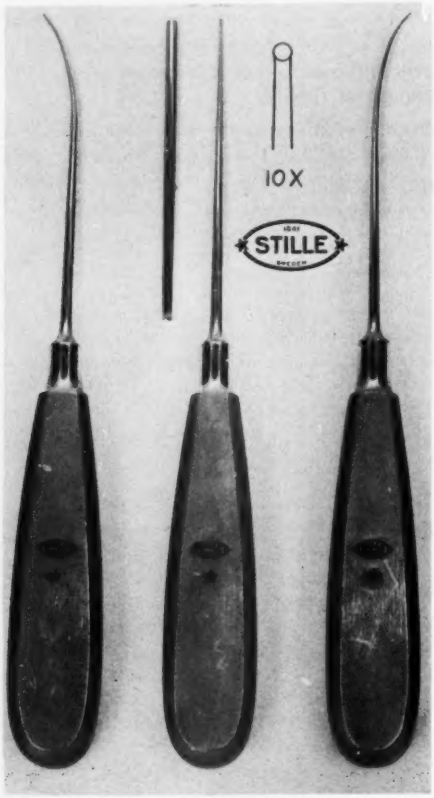

Fig. 7.—Specially constructed curettes with different curvatures.

facial nerve. Even the wall of the promontory may vary in thickness, of course, and it is never possible to know how close one is to the cochlear surface—whether the nerves lie in a canal or in a groove.

The foregoing includes a number of ideas concerning the anatomy of the tympanic plexus and its operative extirpation which seem of value to me. It now remains to be proved that the hypothetic connections between the different nerve systems actually exist and that tinnitus can be affected by means of the aforementioned operative therapy and to mention indications justifying the operation. In subse-

quent articles, which are in progress, I hope to be able to demonstrate the importance of tympanosympathectomy in the operative treatment of Ménière's disease as well as on the basis of 100 such operations performed thus far for different pathologic conditions and to be able to present a conception of the conditions under which tympanosympathectomy is indicated. I also hope, through continued studies of clinical material during operations and more thorough histological examinations of preparations in association with Dr. Engström, to have the opportunity to see the relation of the autonomic nervous system and the rest of the nerves to each other in the tympanic plexus and, also, the possible connections between the plexus and the eighth nerve.

Karlavägen 41.

NEW APPROACH TO VENTRAL DEFLECTIONS OF THE NASAL SEPTUM

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FOR SURGICAL purposes the nasal septum may be divided into a ventral (anterior) and a dorsal (posterior) part by an imaginary line drawn from the base of the spine of the frontal bone to the base of the spine of the maxillae (Fig. 1). In the treatment of deflections of the dorsal (posterior) part, basic concepts are generally accepted and techniques more or less standardized; therefore, these deflections will not be discussed. The management of the anterior division, however, is still a matter of conflicting opinions. The aim of this paper is to present our experience in the hope that it may clear up some of the existing confusion.

There are three areas of the ventral (anterior) division (Fig. 2) in which deflections may occur either alone or in combination, and the deflections may be classified as follows:

Those without associated external nasal deformity
- Osseous
- Upper cartilaginous
- Lower cartilaginous

Those with associated external nasal deformity
- Osseous
- Upper cartilaginous
- Lower cartilaginous

Any combination of the above

The question naturally arises why the corrective procedures so effective in deflections in the dorsal part should not apply equally to those in the ventral. The answer lies in the etiological, physiological, pathological, and architectural differences in these two areas. Etiologically, because of the exposed position of the ventral portion of the septum, deflections there are principally traumatic. Physiologically, this area represents the main pathway taken by the respiratory current, and because of its narrow caliber even a slight deviation is likely to cause a

greater disturbance of function than a "corkscrew" deformity in the wider dorsal region. Pathologically, not only the septum is involved but usually the nasal pyramid as well (Fig. 3). The latter must frequently be shifted into the midline before the

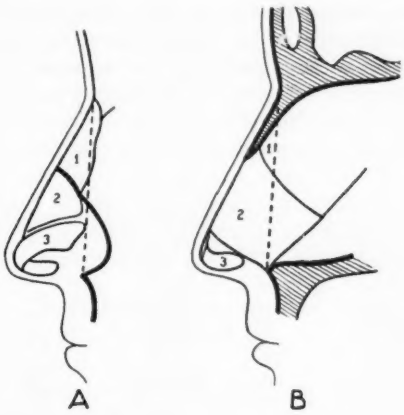

Fig. 1.—Division of nasal septum into ventral (anterior) and dorsal (posterior) parts by dotted line from nasal spine of frontal bone to nasal spine of maxillae. *A*, ectal view; *B*, ental view; *1*, osseous-vault septum, *2*, upper-cartilaginous vault septum, and *3*, lower-cartilaginous vault septum.

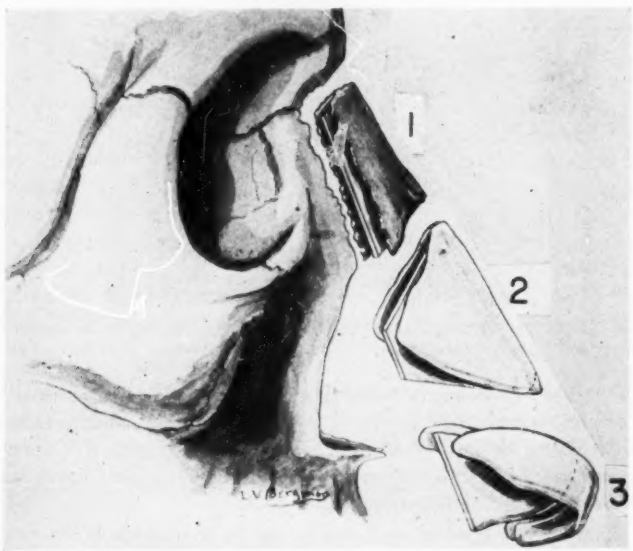

Fig. 2.—Division of ventral part of septum into (*1*) osseous vault, (*2*) upper cartilaginous vault, and (*3*) lower cartilaginous vault.

septum can be brought into a sagittal plane. The architectural supportive value of the septum in the ventral portion becomes a moot question.

Deflections of the ventral portion of the septum not associated with external deformity are a purely septal problem. Those with deformity obviously involve the external nasal pyramid and call for an over-all reconstruction which must include cover (skin, subcutaneous tissue, and muscle), lining (vestibular skin, mucoperichondrium, and mucoperiosteum), and supportive skeletal framework (nasal bones, frontal processes of the maxillae, and upper and lower lateral cartilages). In these deflections the cover and lining must be separated from their abnormal attachments, not only to provide access to the skeleton but also to release traction forces and permit the readaptation of these structures to the straightened pyramid. If there has been no loss of tissue, no problem is presented; but if, as a result of

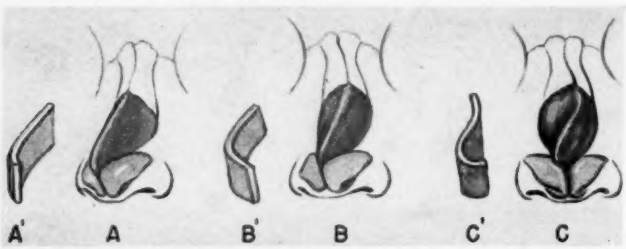

Fig. 3.—Ventral deflections of septum with involvement of external nasal pyramid. *A*, nose shifted to right side; *A'*, septal cartilage; *B*, angulated deflections; *B'*, septal cartilage; *C*, S-shaped deflection, and *C'*, septal cartilage.

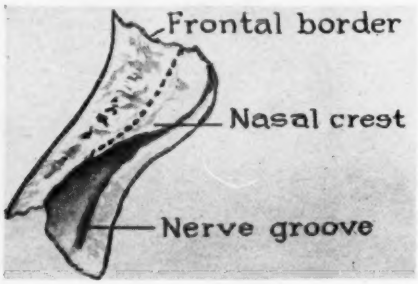

Fig. 4.—Medial view of nasal bone. Area behind dotted line represents anomalous crests forming osseous septum.

injury or disease, cover and or lining are deficient, they will have to be replaced by skin or mucous-membrane grafts. Otherwise the cicatricial contraction arising from the healing of the uncovered raw area will cause a recurrence of the deformity. Usually the skeletal framework must be mobilized and readjusted before the septum can be shifted into a central position (Fig. 3).

Deflections of the osseous-vault septum are easily corrected, inasmuch as the supportive value of the septum here is not a factor. If there is no external deformity, the septal deviation or thickening is treated in the same manner as a dorsal dislocation. If there is an associated deviation of the bony arch, the two sides must be equalized (by removal of a section from the broader flat side) and

the walls mobilized and shifted into the midline. This automatically fractures the deviated thin bony septum beneath and brings it into the sagittal plane. Occasionally the septum in this location is composed solely of the crest of the nasal bone or the spine of the frontal bone (Fig. 4). Under these circumstances it can be removed only by the excision of the crest or the spine with a chisel.

The management of the upper cartilaginous vault septum is subject to dispute, owing to the divided opinion as to the supportive value of the septum. Perhaps we can bring the controversy into a sharper focus by recounting the milestones in the surgical history.

Before 1900, when anatomy was principally descriptive, the septum was considered the main support of the external nasal pyramid and as such was likened to a tent pole. Obviously such a concept precluded the removal of any part for fear of causing saddling. Basically, the operative procedures consisted of crushing the deflected septum between the blades of forceps and maintaining it in a central position with packs or splints. An example is the procedure of Asch.[1] While by the crushing procedure the friable bony septum could be straightened, the cartilaginous portion, because of its elasticity and resiliency, could be neither straightened nor stabilized by this means.

With the turn of the century the domain of anatomy expanded to include an ontogenetic, phylogenetic, evolutionary, and physiological viewpoint, with a resultant change in concept. It was then thought that a good part of the septum could be removed without collapse of the nasal pyramid, provided that certain strategic segments were left intact—namely, a ventral and a caudal (columellar) buttress. This general opinion was expressed by Freer[2] in 1902, in an article in *The Journal of the American Medical Association* entitled "The Correction of Deflections of the Nasal Septum with a Minimum of Traumatism." Freer writes that the nasal septum is not a supporting wall but merely a division between the nares. The intrinsic cartilage of the external nose, the nasal bones, and the anterior edge of the septal cartilage maintain the form of the nose even when the rest of the septum is gone. With this in mind the central portion of the septum was removed, enough ventral and caudal buttress being left to maintain the external configuration. Examples of this procedure are given by Freer[3] and Killian.[4] This procedure represented a great advance over the redressment type of operation but was obviously incapable of correcting faults in the most ventral and caudal portions, which in themselves often constitute a part or all of the obstruction.

In 1929 Metzenbaum[5] attacked the problem of displacements of the caudal buttress and described a procedure for their correction. He freed the membrane

1. Asch, M. J.: Treatment of Nasal Stenosis Due to Deflective Septa, With or Without Thickening of Convex Side, Laryngoscope **6**:340-343 (June) 1899.

2. Freer, O. T.: The Correction of Deflections of the Nasal Septum with a Minimum of Traumatism, J. A. M. A. **38**:636-642 (March 8) 1902.

3. Freer, O. T.: Deflections of the Nasal Septum, Ann. Otol. Rhin. & Laryng. **14**:213-266 (June) 1905.

4. Killian, G.: The Submucous Window Resection of the Nasal Septum, translated by E. Edwin Foster, Ann. Otol. Rhin. & Laryng, **14**:363-393 (June) 1905.

5. Metzenbaum, M.: Replacement of the Lower End of the Dislocated Septal Cartilage, Versus Submucous Resection of the Dislocated End of the Septal Cartilage, Arch. Otolaryng. **9**:282-296 (March) 1929.

on one side, removed a wedge of cartilage at the angle of deflection, and on the mucoperichondrial hinge thus created swung the caudal part of the septum to the midline and fixed it to the columella. Peer [6] in 1937 removed the caudal buttress and implanted it in a pocket in the columella. Many modifications of these procedures have since been employed,[7] but their utility is limited. While they are capable of correcting the caudal displacement in cases in which the "guy ropes" (upper lateral cartilages) are not involved, they are ineffectual in deflections associated with pathological changes in the upper lateral cartilages. Nevertheless, we owe much to these pioneers for the part they played in laying the groundwork for the repair of these deformities.

As regards the ventral buttress—obviously, if one subscribes to the belief that this portion of the septum is essential to the support of the nose, corrective procedures must be limited to slicing, cross hatching, mobilizing, or resecting the septum short of its removal. We have used most of the suggested methods and some of our own. The immediate result is usually good, but in a certain percentage of cases a septum straightened in this manner later reverts to its former shape. Because of this uncertainty, we sought other procedures. Our clinical experience showed that the cartilage is usually deformed both in a ventrodorsal and in a cephalocaudal plane. Slicing will straighten some cartilages, especially when the deformity is acquired or in one plane, but it will fail to straighten others, particularly the congenital types or those in which more than one plane is involved. We have sliced deformed cartilage as fine as the teeth of a comb, and in spite of this each segment retained its original shape. Schattner [8] graphically compares this procedure to the slicing of a rubber ball. Only by cross cutting the cartilage is it possible to alter all planes of curvature. But there, since it is essential that the segments of cartilage be left attached to the short concave or to the long convex membrane, this procedure is frequently unsuccessful, due to the unequal traction resulting from the disparity of the membranes.

We have also mobilized the cartilage in the form of a trap door, freeing it ventrally by cutting through the upper lateral cartilages, caudally by sectioning the membranous septum, and dorsally by cutting through the septal cartilage or maxillary and palatine crest and removing a segment from the angle of deflection,[9] so

6. Peer, L. A.: An Operation to Replace Lateral Displacement of the Lower Border of the Septal Cartilage, Arch. Otolaryng. **25**:475-477 (April) 1937.

7. (*a*) Becker, O. J.: Aids in Rhinoplastic Procedures, Ann. Otol. Rhin. & Laryng. **55**:562-571 (Sept.) 1946. (*b*) Cohen, S.: Role of the Septum in Surgery of Nasal Contour, Arch. Otolaryng. **30**:12-20 (July) 1939. (*c*) Fomon, S.; Syracuse, V. R.; Bolotow, N. A., and Pullen, E. M.: Plastic Repair of the Deflected Nasal Septum, ibid. **44**:141-156 (Aug.) 1946. (*d*) Fomon, S.; Gilbert, J. G.; Silver, A. G., and Syracuse, V. R.: Plastic Repair of the Obstructing Nasal Septum, ibid. **47**:7-20 (Jan.) 1948. (*e*) Salinger, S.: Deviation of the Septum in Relation to the Twisted Nose, ibid. **29**:520-532 (March) 1939. (*f*) Seltzer, A. P.: The Nasal Septum: Plastic Repair of the Deviated Septum Associated with a Deflected Tip, ibid. **40**:433-444 (Dec.) 1944. (*g*) Cottle, M. H., and Loring, R. M.: Surgery of Nasal Septum: New Operative Procedures and Indications, Ann. Otol. Rhin. & Laryng. **57**:705-713 (Sept.) 1948; Corrective Surgery of External Nasal Pyramid and Nasal Septum for Restoration of Normal Physiology, Illinois M. J. **90**:119-131 (Aug.) 1946.

8. Schattner, A.: Personal communication to the authors.

9. Ersner, M. S.: Rhinoplastic Procedures to Establish Normal Physiologic Nasal Function, Pennsylvania M. J. **51**:749-754 (April) 1948. Converse, J. M.: Corrective Surgery of Nasal Deviations, Arch. Otolaryng. **52**:671-708 (Nov.) 1950.

that the cartilage could be swung to the midline on a mucoperichondrial hinge. The results of this method proved as uncertain as slicing and partial resectioning.

As a last resort we felt that only by separating the membrane on both sides, removing the deformed cartilage, replacing it with a straight piece, and readjusting the membrane to the introduced cartilage could there be an assurance against recurrence. With this in mind we excised the ventral part of the septum, with the expectation of a resultant saddle which we planned to correct. To our surprise, saddling did not occur. After frequent repetitions of the procedure we were forced

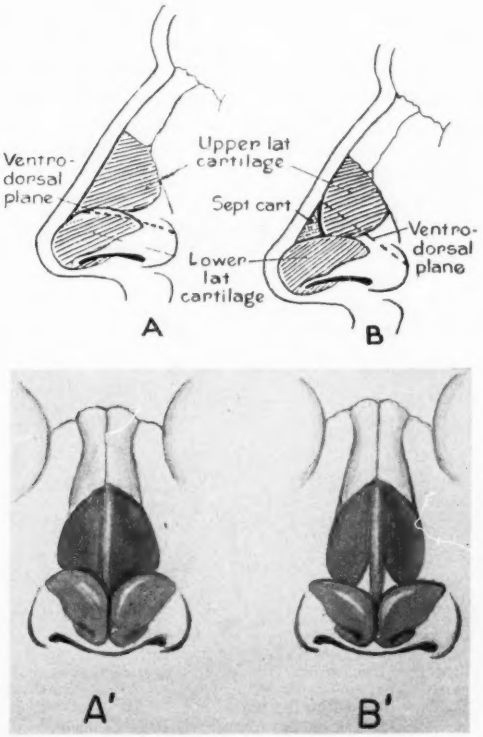

Fig. 5.—Architecture of external nasal pyramid. *A*, lateral view of upper lateral cartilage extending to caudal end of septum; *A'*, frontal view; *B*, lateral view of upper lateral cartilage swinging away from septum above its caudal margin, and *B'*, frontal view. Submucous resection in *A* will not cause saddling; in *B* saddling is likely to result.

to assume that the upper and lower lateral cartilages were capable of maintaining the nasal profile line without the aid of the septum.

This conclusion was not hastily drawn, for it was so contrary to the accepted belief that we clinically checked and rechecked our observations. In the few instances in which saddling did occur at the time of the operation, we found upon examination that the upper lateral cartilages swung away from the septum at an abnormally high level or the lower lateral cartilages were either poorly developed

or failed to overlap the upper lateral cartilages (Fig. 5). After this experience, we made it a routine practice to examine the architecture of the external nasal pyramid prior to operation. As a result we were able to foretell in which cases immediate saddling would or would not take place. In those cases in which saddling occurred weeks after operation, we could attribute it only to the contraction of the deskeletonized membranes. To counteract this tendency, we prophylactically introduced cartilage between the membranes at the time of operation. After considerable clinical observation we reported the procedure in 1946,[7c] with modifications in 1948.[7d]

As our experience grew, we found that the supportive strength of the upper and lower lateral cartilages had been underestimated and that if a careful preoperative appraisal of the anatomy was made, the introduction of cartilage could be dispensed with except (1) when saddling occurs at the time of operation due to the reasons given above, (2) in the case of extensive lacerations of the membranes with expected excessive contraction, (3) when the membranes are redundant, with

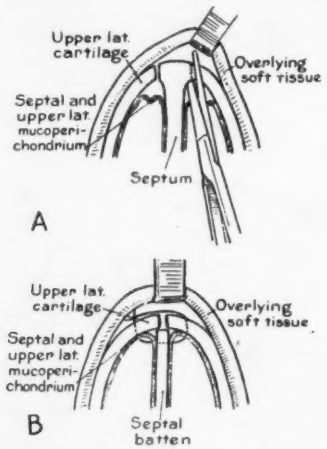

Fig. 6.—Procedure for maintaining continuity of mucoperichondrium. *A*, soft tissues elevated, mucoperichondrium separated from septum and upper lateral cartilages, and upper lateral cartilages cut from septum; *B*, batten introduced between septal membranes and fixed to upper lateral cartilages with absorbable surgical sutures.

a tendency to sway in the respiratory current, (4) in anticipated perforations in which the cartilage is introduced between the membranes to prevent the epithelium of both sides from coming in contact, and (5) in retractions of the columella.

In deflections of the septum involving the upper lateral cartilages, the latter structures require straightening, unbuckling, or equalization. This necessitates their separation from the septum, and here two problems presented themselves. The first was how to prevent the mucoperichondrial flaps, after their separation from the septum and upper lateral cartilages, from being "lost" on the floor of the nose. This problem we solved by elevating the septal mucosa in the customary manner and continuing the dissection beneath the upper lateral cartilages (Fig. 6), thus leaving the membrane intact.

The second problem concerned the supportive value of the septum. While we were satisfied that the upper and lower lateral cartilages when adequate (Fig. 5) could maintain the profile projection of the nose without the aid of the septum, we were not so sure whether or not this would apply when the upper lateral cartilages were cut away from the septum. In a case in which all other procedures had failed and with considerable trepidation we uncovered the nasal framework, introduced an angulated retractor to guard the overlying skin, and cut away the upper lateral cartilages from the septum with a No. 11 Bard Parker knife, leaving the mucosa intact. We then removed the deflected septum and treated the upper

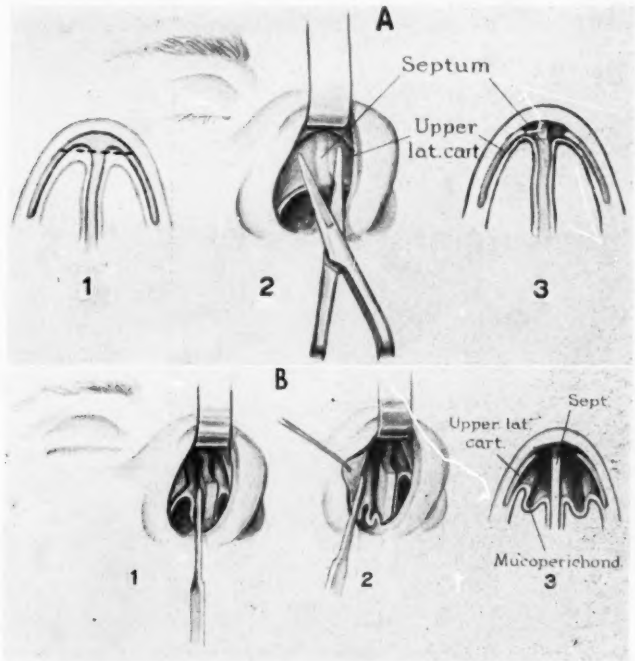

Fig. 7.—*A*, exposure of mucoperichondrium: *1*, soft tissue and cartilage sliced until mucoperichrondrium comes into view; *2*, sectional view, dotted line indicates amount to be removed; *3*, mucoperichondrium as hinge between septum and upper lateral cartilages. *B*, separation of mucoperichondrium: *1*, mucoperichondrium separated from septum in a ventrodorsal direction (from above down); *2*, mucoperichondrium separated from upper lateral cartilage; *3*, sectional view.

lateral cartilages as indicated. We introduced a batten of cartilage between the septal membranes and fixed it to the upper lateral cartilages with one or two absorbable surgical sutures (Fig. 6). This procedure we repeated several times and came to the conclusion that the upper lateral cartilages were capable of maintaining the profile projection of the nose even when separated from the septum, provided the membranes remained intact. We reported our experience in 1948.[7d]

Through sad experience we learned that in narrowing the nose in such cases the packing should be introduced before the bones are shifted into the midline, to obviate the danger of a backward displacement of the nasal pyramid.

While the above procedure accomplished the purpose, it entailed technical difficulties in that it had to be carried out from below, in the narrowest part of the gable. Through trial and error we have gradually overcome this objectionable feature by using a new approach from above which provides a better view and more freedom of action. The method has been sufficiently tested to demonstrate its clinical worth. The details of the technique are:

1. Assuming that the soft parts overlying the bony and cartilaginous vaults have been elevated and the membranous septum cut through, a retractor is introduced beneath the skin. With angulated scissors the soft tissue is trimmed down until the septal and upper lateral

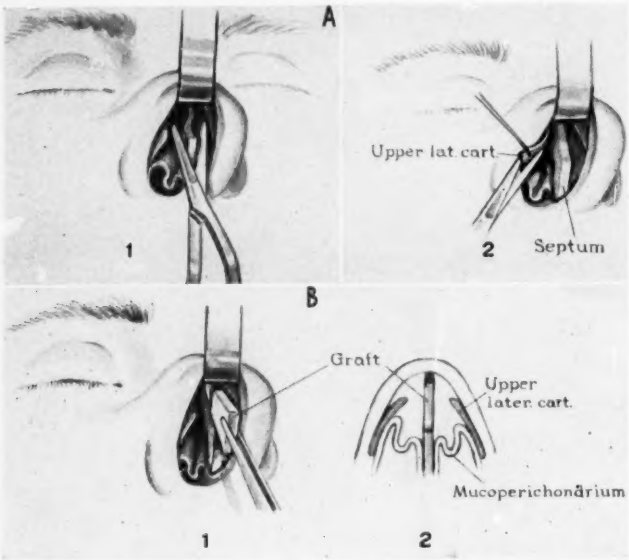

Fig. 8.—*A*, excision of deformed cartilage: *1*, septal cartilage; *2*, upper lateral cartilage. *B*, replacement of septal cartilage: *1*, introduction of graft; *2*, diagrammatic view.

cartilages come into view. The cartilages are sliced down to the mucoperichondrium, which is left as a hinge between the septum and the upper lateral cartilages (Fig. 7*A*).

2. The mucoperichondrium is elevated from the septum in a ventrodorsal direction (anteroposteriorly) (Fig. 7*B1*).

3. The upper lateral cartilages are grasped with a hook, and the mucoperichondrium is peeled off (Fig. 7*B2*), the amount of separation depending on the extent of the deformity. (The membrane lining the septum and upper lateral cartilages will be found to separate more readily from above down than from below up.)

4. With angulated scissors under direct vision the deformed ventral part of the septum is excised (Fig. 8*A 1*).

5. The denuded upper lateral cartilages are trimmed, straightened, cross hatched, or resected, as indicated by the pathological changes (Fig. 8*A2*).

6. The deformed septal cartilage which was resected is replaced with a straight piece obtained either from the excised cartilage or from "pickled" cartilage. To insure a proper profile contour, the graft is placed between the upper lateral cartilages in such a manner that it projects a few millimeters beyond the dorsal line (Fig. 8*B*). It is fixed in this position with two or three absorbable surgical sutures passing through the full thickness of the nose (skin, upper lateral cartilages, and graft) (Fig. 9*A1* and *2*). With an angulated retractor the soft tissues overlying the dorsum are elevated, and the sutures thus brought into view are caught with a dural hook and the ends pulled out where they pass between the skin and upper cartilaginous vault

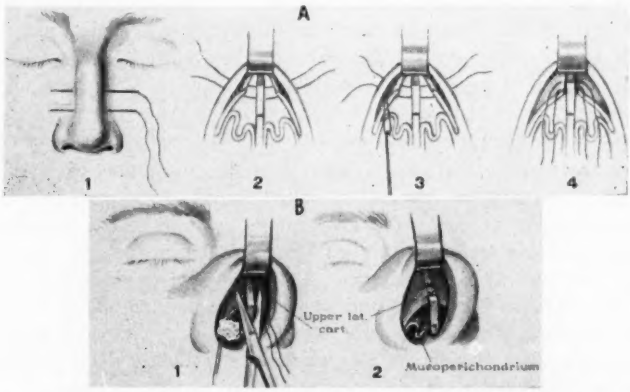

Fig. 9.—*A*, fixation of graft: *1*, sutures passing through full thickness of nose; *2*, sectional view; *3*, soft structures elevated and sutures brought into view between skin and upper cartilaginous vault; *4*, sutures delivered. *B*, creation of profile projection: *1*, cartilage graft trimmed down to proper profile angle; *2*, sutures tied.

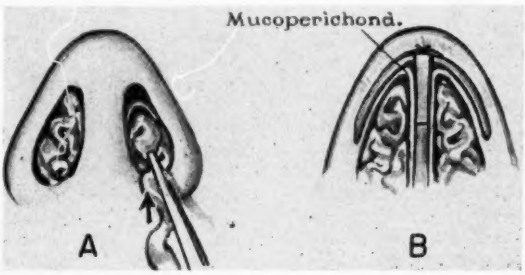

Fig. 10.—Packing. *A*, nose packed with petrolatum gauze to apply membrane to graft and upper lateral cartilages; *B*, sectional view.

(Fig. 9*A3* and *4*). The septal-cartilage graft is trimmed down to the proper profile projection (Fig. 9*B1*), and the sutures are tied (Fig. 9*B2*).

7. The nose is tightly packed with petrolatum gauze to apply the membrane to the graft and upper lateral cartilages and to obliterate dead spaces (Fig. 10). The membrane being intact, there is no danger of the packing being forced beneath the skin.

The advantages of this procedure over that carried out from below are its greater simplicity and clearer visibility.

Deflections of the lower cartilaginous vault septum may be congenital as part of the harelip or cleft palate deformity or may accompany a general facial asymmetry. Usually they are secondary to deflections of the middle cartilaginous vault. They may also result from cicatricial contractions around the vestibule due to disease or injury. Correction is brought about automatically by elimination of the primary cause.

COMMENT

Septal surgery has been carried out systematically and with increasing thoughtfulness. Today techniques have been developed to such a degree that the rhinologist can with the greatest assurance clear the airway by realigning, unbuckling, or removing a part or all of any deflected septum. This feeling of confidence is lacking, however, when it comes to the restoration of function. We have all had the embarrassing experience of doing what we believed was a technically perfect septal operation, only to leave the patient no better off functionally than he was before.

If we are to have the same assurance in the restoration of function as in anatomical reconstruction, it would seem that we should expand our knowledge along the following channels: (1) an accurate diagnosis of the causative factors, (2) a precise knowledge of the course taken by the air current, (3) tests to determine the efficacy of the operation, and (4) a postoperative study of the functional value. The latter has been haphazard, unsystematic, and too often left unrecorded. It would be interesting, among many other problems, to know the percentage of cases in which there was success, the effect on olfaction, and the reaction of the membranes following operation.

SUMMARY

The problems presented by ventral displacements of the septum are reviewed, and a new approach for their correction is described. The need for further study along physiological lines is suggested.

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115 E. 61st St. (21).

A STATISTICAL STUDY OF PURE TONE AUDIOMETRY IN RELATION TO THE FENESTRATION OPERATION

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IOWA CITY

FENESTRATION of the labyrinthine capsule for the relief of deafness due to clinical otosclerosis has become an established practice, but during its evolution it created one of the most controversial issues in otology. Since the earliest attempts to relieve deafness by surgery ended in failure,[1] the prospect of obtaining any measure of success remained clouded by skepticism, even after Dr. Julius Lempert, of New York, succeeded in improving the hearing of patients whose loss was attributed to stapedial fixation due to otosclerosis.[2] With the fundamental achievements of Holmgren [3] and Sourdille [4] spectacularly brought to a climax by Lempert in 1938, sound principles of selection were defined, which, in general, outlined the requirements for a successful surgical result.[5]

Twelve years have now elapsed since Lempert gave to otology his revolutionary key to the surgical management of clinical otosclerosis. During that period attention has been turned to many of the related problems, among which criteria for selection have absorbed much effort. Dissatisfied with the reliability of audiometric revelations concerning cochlear function, Lempert, Wever, and Lawrence attempted to devise a practical method of recording cochlear potentials.[6] The search, while partially successful, was ultimately brought to a close because the method proved

From the Department of Otolaryngology and Oral Surgery, University Hospitals, State University of Iowa.

Presented as a candidate's thesis to the American Laryngological, Rhinological and Otological Society, Inc., Jan. 1, 1951.

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impractical and uncertain.[7] G. E. Shambaugh, Jr., referring to pure tone audiometry among other considerations, set up standards according to his impression of classes A, B, and C but did not draw sharp limitations distinguishing each class.[8] Others followed much the same pattern.[9] Thurlow and others conducted an elaborate statistical study in which a number of hearing tests were employed to determine the value of such tests for predicting improvement of hearing by the operation. They concluded that none of the tests employed showed any great predictive value.[10] This report was followed by another, by Davis, who pointed out that adequate hearing improvement for speech depended not only upon an improvement in hearing as measured on the decibel scale but also upon discrimination, which may be influenced adversely by high tone nerve deafness. These considerations were combined in calculations used to determine the "social adequacy index of hearing."[11] To a certain extent, these factors have been indirectly considered in the present analysis in that considerable emphasis has been placed on the importance of high tone hearing for judging the degree of improvement which may result from fenestration surgery.

Earlier, Smith had asked: "What result can be obtained with good bone conduction for the 512 and 1024 frequencies, but a drop for the 2048 frequency? How low should the recession be for the 2048 frequency before the operation is contraindicated?"[12]

The sole purpose of creating a window in the horizontal semicircular canal in a patient with clinical otosclerosis is to establish an improvement of hearing. The amount of improvement and the level to which the hearing may be improved are dependent on accurate selection, surgical skill, and appropriate postoperative management. To find out to what extent each influences achievement of hearing improvement became the purpose of a project initiated in July, 1947. At the outset, this project was concerned only with the data acquired with the facilities and in the circumstances prevailing in my own organization. It became apparent as the study progressed that similar measures might be extended to others.

OBJECTIVES

The objectives of the studies which were concurrently undertaken were threefold: (1) to develop dependable standards by which criteria for selection, surgical

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8. Shambaugh, G. E., Jr.: A Modified Fenestration Technic: Analysis of Results in 141 Consecutive Operations, Arch. Otolaryng. **36**:23-46 (July) 1942. Shambaugh, G. E., Jr.: The Fenestration Operation: An Evaluation of Its Present Status, Surg., Gynec. & Obst. **84**:828-838, 1947. Shambaugh, G. E., Jr.: Fenestration Operation for Otosclerosis, Acta oto-laryng. Supp. 79, pp. 10-100, 1949.

9. House, H.: Indications for the Fenestration Operation, Arch. Otolaryng. **45**:312-318 (March) 1947. Ewertsen, H.: Acoustic Function Before and After Operation for Otosclerosis, ibid. **49**:393-401 (April) 1949.

10. Thurlow, W. R.; Silverman, S. R.; Davis, H., and Walsh, T. E.: A Statistical Study of Auditory Tests in Relation to the Fenestration Operation, Laryngoscope **58**:43-66, 1948.

11. Davis, H.: The Articulation Area and the Social Adequacy Index for Hearing, Laryngoscope **58**:761-778, 1948.

12. Smith, J. M.: The Fenestration Operation for Otosclerosis: A Report of 32 Cases, Arch. Otolaryng. **37**:124-182, 1943.

techniques, and postoperative procedures and management may be evaluated; (2) to study the physical and functional factors associated with the diagnosis of clinical otosclerosis in a group of patients on whom fenestration had been done in order to determine what features, if any, have precise prognostic value; (3) to search for a useful, simple, but accurate audiometric method of selection which would predict with minimum reservations and with maximum reliability the results of the fenestration technique used.

This report will deal primarily with the significance of the audiometric data as they apply to criteria for selection and prognosis of hearing following surgery.

METHODS

The case records of the first 69 consecutive patients of a group upon whom fenestration surgery had been performed were thoroughly processed as to both the preoperative and the postoperative hearing status. Correlations were sought between age, sex, and the hearing result measured at regular intervals postoperatively. Test results obtained for a period of at least six months after operation were considered in these calculations. All tests were performed under research conditions and were administered by either of two persons whose experience qualify them as experts in audiometry. Results of spondee and phonetically balanced word tests, with and without one or more hearing aids, were obtained preoperatively and compared with the postoperative unaided hearing. At least three pure tone audiograms were required for selection. If a significant variation occurred among them, additional audiograms were required. Although both air and bone conduction acuity measurements were obtained at octave intervals from 64 to 8192 cycles inclusive, only the results at 512, 1024, and 2048 cycles are considered here. The bone conduction vibrator used in obtaining measurements of bone conduction acuity is a precision instrument carefully calibrated on young adults with normal air conduction acuity in an exceedingly quiet room. The vibrator is mounted in a spring headband so that it is held with approximately the same pressure against each patient's mastoid process. A more complete description of the bone conduction receiver and its calibration was reported by Lierle and Reger.[13]

The surgical technique used throughout the pursuit of the studies conformed essentially with the fundamental principles of the fenestration operation described by Lempert.[14] No significant modifications were employed. Hence the data presented may be considered to have been derived under rather stable conditions.

In order to ascertain the value of the pure tone auditory acuity in relation to predictability of surgical result, presurgical bone conduction acuity at 512, 1024, and 2048 cps was compared with postoperative air conduction acuity at the same frequencies individually as well as with the average of the three frequencies. Also, cochlear reserve, i. e., the difference between bone and air conduction thresholds at 512, 1024, and 2048 cps preoperatively, was statistically matched with the postoperative air conduction results.

Thus six variables, as recorded in the legend of Table 1, were considered. Zero order correlations were run between each of these and the postoperative air conduction acuity as well as with one another (Table 1). Zero order correlations are used to reveal how two separate measures vary together. If two measures change in the same amount in the same direction they are rated as correlating +1.0. If they vary in the same amount but in the opposite direction they are rated as −1.0. No relationship at all is shown by a correlation coefficient of 0.0. It is obvious, then, that one measure can be perfectly predicted by knowledge of the other if they

13. Lierle, M. D., and Reger, S. N.: Correlations Between Bone and Air Conduction Acuity Measurements Over Wide Frequency Ranges in Different Types of Hearing Impairment, Laryngoscope **56**:187-224, 1946.

14. Lempert, J.: Fenestra Nov-Ovalis: A New Oval Window for the Improvement of Hearing in Cases of Otosclerosis, Arch. Otolaryng. **34**:880-912 (Nov.) 1941; Bone-Dust-Free Lempert Fenestra Nov-Ovalis: A New Evolutionary Development of the Surgical Treatment of Clinical Otosclerosis, ibid. **47**:280-288 (March) 1948.

are correlated either + or — 1.0. Coefficients which show less than perfect relationships are then less predictable and introduce a margin of error.

"Simple relationships between two isolated variables are the exception rather than the rule. Every effect is traceable to a number of causes, antecedents or concomitants. Our task is that of determining to what extent the effect or dependent variable is determined by each one of the causal factors and to what extent the pool of the causal factors acting jointly can account for the total result." [15] These considerations are taken into account in determining the coefficient correlation between variables.

An index of reciprocal relationship of +0.731 was arrived at by correlating the preoperative bone conduction at 2048 cps and the average postoperative air conduction acuity, hereinafter referred to as criterion hearing or criterion audition. This was the highest, hence the most

TABLE 1.—*Relation of Six Variables*

	Crit.	Var. 1	Var. 2	Var. 3	Var. 4	Var. 5	Var. 6
Crit	1.0	0.534	0.512	0.731	—0.330	—0.167	—0.146
Var. 1	0.534	1.0	0.800	0.667	—0.562	—0.138	—0.174
Var. 2	0.512	0.800	1.0	0.628	—0.074	—0.098	0.043
Var. 3	0.731	0.667	0.628	1.0	—0.272	—0.325	—0.292
Var. 4	—0.330	—0.562	—0.074	—0.272	1.0	0.727	0.616
Var. 5	—0.167	—0.138	—0.098	—0.325	0.727	1.0	0.506
Var. 6	—0.146	—0.174	0.043	—0.292	0.616	0.506	1.0

Crit. = Criterion audition (postoperative air average).
1 = Preoperative bone at 512
2 = Preoperative bone at 1,024
3 = Preoperative bone at 2,048
4 = Cochlear reserve at 512
5 = Cochlear reserve at 1,024
6 = Cochlear reserve at 2,048

TABLE 2.—*Table of Class Suitability*

Class	B. C.* Limits at 2,048	C. R.† Limits
A	—10 db. to + 15 db.	40 db.
B	+ 15.01 to + 30.0	30 +
C	+ 30.01 to - - -	30 +

* B. C. = Bone conduction.
† C. R. = Cochlear reserve.

TABLE 3.—*Percentage of Classified Patients Who Reached Criterion Audition*

Class	Number in Class	Number Reaching Criterion	Per Cent
A	36	36	100
B	28	21	75
C	5	0	0

predictable, score of all those treated. A coefficient of this magnitude accounts for over 50% of the causal factors in estimating criterion hearing from this one variable. By employing the Wherry-Doolittle formula, it becomes statistically possible to discover whether any of the other variables add to the predictability of this single variable.[16]

Cochlear reserve at 512 cps coupled with preoperative bone conduction threshold at 2048 cps gives a coefficient of +0.741. All other calculable variables alone or in any combination whatsoever detract from the predictability. When the relationship between the preoperative variables mentioned above and the resultant acuity is known, the regression equation may then

15. Guilford, J. P.: Psychometric Methods, New York, McGraw-Hill Book Company, Inc., 1936, Chap. 12, p. 379.

16. Stead, E. L.; Shartle, J. L., and others: Occupational Counseling Techniques, New York, American Book Company, 1940, pp. 245-252.

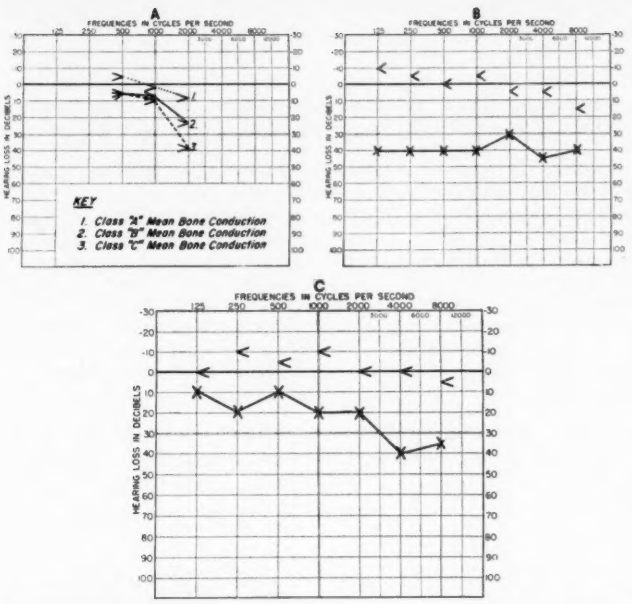
A
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
KEY
1. Class "A" Mean Bone Conduction
2. Class "B" Mean Bone Conduction
3. Class "C" Mean Bone Conduction
B
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
C
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS

Chart 1.—*A*, mean bone conduction. *B*, audiogram of W. B. aged 28 made June 21, 1949, on audiometer No. W.E.2A; class A pre-operative. *C*, audiogram of W. B. made Jan. 14, 1950; postoperative result.

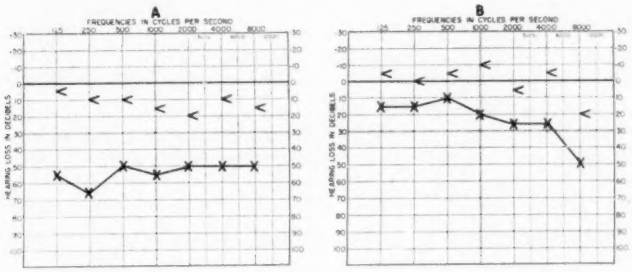
A
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
B
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS

Chart 2.—*A*, audiogram of H. W. aged 48 made July 26, 1949, on audiometer No. W.E.2A; class B pre-operative. *B*, audiogram of H. W. made Jan. 11, 1950; postoperative result.

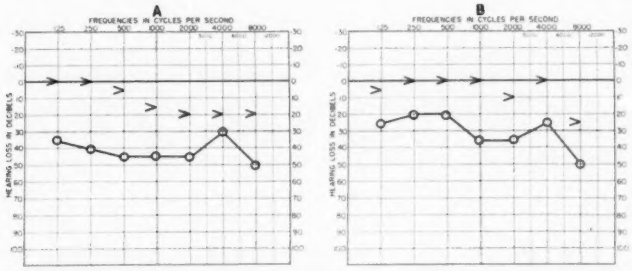
A
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS
B
FREQUENCIES IN CYCLES PER SECOND
125 250 500 1000 2000 4000 8000
HEARING LOSS IN DECIBELS

Chart 3.—*A*, audiogram of D. A. aged 22 made July 22, 1948, on audiometer No. W.E.2A; class B pre-operative. *B*, audiogram of D. A. made Nov. 18, 1949; postoperative result.

be derived to be used to predict criterion hearing.[17] The significance of the regression equation for practical work in this field lies in the fact that it constitutes an objective means of predicting criterion audition for a person when the values of the related variables (preoperative bone conduction at 2048 cps and cochlear reserve at 512 cps) are known for that person and when the degree of correlation between the criterion audition and the variables is known. Thus the equation may be considered the prediction equation or formula.

The prediction equation found in this study is $X=0.59x_1-0.14x_2+21.1$, in which X is the postoperative acuity, x_1 is preoperative bone conduction at 2048 cps, x_2 is cochlear reserve at 512 cps, and 21.1 is a constant which is the numerical differential between the mean values of 1, the variables, and 2, the criterion audition. The numbers 0.59 and —0.14 are the relative weights found for the two variables.

A specification system for selection similar to that described by Kos and Reger was used throughout the course of these studies.[18] In addition, the magnitude of cochlear reserve was considered for clearer definition. Table 2 shows the values for class identification, and Table 3 shows the percentage of classified patients who reached criterion audition.

Audiograms illustrating the typical preoperative air conduction and bone conduction levels and the postoperative thresholds for each class are shown in Charts 1 to 4 inclusive. An example of a successful result (30 db. or better) in class B is shown in Charts 2*A* and *B* and of a failure (less than 30 db.) in class B is

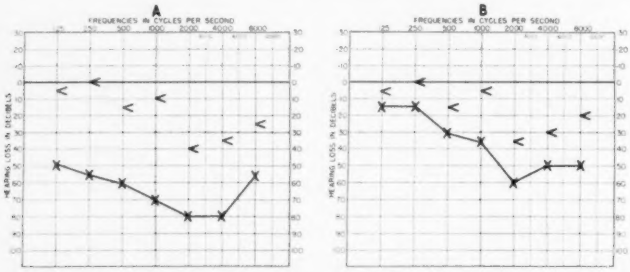

Chart 4.—*A*, audiogram of P. E. aged 34 made Nov. 10, 1948, on audiometer No. W.E.2A: class C pre-operative. *B*, audiogram of P. E. made December 10; postoperative result.

shown in Charts 3*A* and *B*. The two patients had the same bone conduction level at 2048 cycles and the same cochlear reserve at 512 cycles preoperatively.

RESULTS

The ages of the patients studied ranged from 15 to 58 yr. There were 15 males and 54 females. The range in average gain in hearing acuity for 68 of the 69 patients was 7 to 42 db. across the three principal frequencies. One patient sustained an average loss of 4 db. without obvious cause. The spread of gain for each class is shown in Table 4. The mean gain per class is shown in Table 5. No discernible relationship existed among age, sex, and postoperative result. Otoscopic inspection failed to reveal any evidence of significance. The data obtained from spondee and phonetically balanced word tests are excluded here for publication

17. Linquist, E. F.: A First Course in Statistics, revised ed., Boston, Houghton Mifflin Company, 1942.

18. Kos, C. M., and Reger, S. N.: Selection of Patients for Fenestration Surgery, Arch. Otolaryng. **51**:707-723 (May) 1950.

elsewhere after further study. The pure tone results presented here do not warrant the assumption that hearing for speech is predictable to the extent that hearing for pure tones may be predictable.

An analysis of the audiometric measurements of the 69 patients who had undergone fenestration operations revealed that the bone conduction threshold at 2048 cps and the cochlear reserve at 512 cps constitute elements of prognostic value at a rather high level of confidence. The preoperative mean levels of bone conduction acuity at 512, 1024, and 2048 cps for the three classes A, B, and C indicate that the general slope of the hearing curve must be taken into account in the process of selection if adequate improvement is to be expected (Table 6). The characteristic tendency of the bone conduction thresholds to form a curve which tends downward from low to high frequencies naturally gives to the preoperative bone conduction threshold of 2048 cps considerable weight in relation to prediction. The greater the

TABLE 4.—*Spread of Gain Per Class*

Gain A	7.0 db to 38.6 db
Gain B	−4.1 db to 42.4 db
Gain C	8.6 db to 37.0 db

TABLE 5.—*Mean Gain Per Class*

Class A	24.07
Class B	21.50
Class C	18.18

These differences are not significant at either the 5% or 1% level of confidence.

TABLE 6.—*Mean Bone Conduction*

	Preoperatively		
	Class A	Class B	Class C
512 Bone	−3.02	3.07	4.67
1,024 Bone	0.44	6.6	10.5
2,048 Bone	9.78	22.78	37.16

loss at this frequency, the more the acuity will be depressed at the two lower frequencies (Chart 1). Thus any system of predictable significance must hinge upon the audiometric threshold at which the 2048 frequency is heard preoperatively.

The method of classifying subjects into compartments A, B, and C, like other methods of similar nature, does not cover all the possibilities with regard to variations that may occur between preoperative bone conduction acuity at 2048 cps and cochlear reserve at 512 cps. Hence it may be used only as an outline for selection purposes. The prediction equation, on the contrary, delivers predictions without regard for such class limitations and may be used with considerably more confidence. Nevertheless, in any relationship which is less than perfect an error is introduced. The poorer the relationship, the greater the uncertainty. This uncertainty can be calculated, however, and the result is called the standard error of the estimate.

The standard error of the estimate in this study proved to be ± 5 db. with 68% accuracy and ± 10 db. with 95% accuracy. In other words, 68 times out of 100 the predictions will be within ± 5 db., and 95 times out of 100 the hearing

acuity for pure tones 512, 1024, and 2048 cps resulting from surgery will be within ± 10 db. of the prediction. Moreover, if the prediction is that postoperative air conduction acuity for the subject frequencies will reach a level better than average 30 db., the chances of attaining hearing acuity at 30 db. or better are increased as prediction approaches normal hearing. For example: If preoperative bone conduction at 2048 cycles is 15 db. and cochlear reaction at 512 cycles is 40 db., the criterion audition is an average 24.3 db. The chances that the hearing acuity for 512, 1024, and 2048 cps, in this case, will be at least 30 db. or better are 85%. If preoperative bone conduction at 2048 cps were 20 db. and cochlear reaction at 512 cps were 60 db., nearly the same prediction might be expected with the same chance of achieving a level of 30 db. or better.

COMMENT

It should be emphasized at this point that this investigation was undertaken in order to find elements of predictable value, not to report successes and failures or to argue the merits of one surgical technique against another. However desirable it may be to have a method of assessing various surgical and postoperative pro-

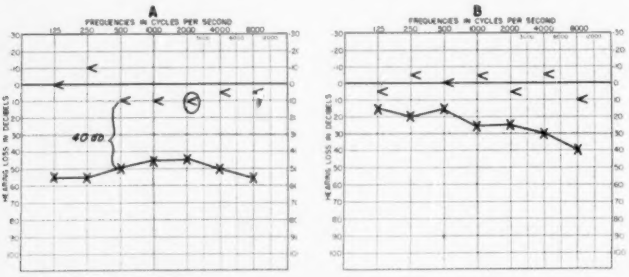

Chart 5.—*A*, audiogram of M. S. aged 36 made July 10, 1950, on audiometer No. W.E.2A; class A pre-operative; criterion audition predicted, 21.4 db.; probability of 30 db. or more hearing improvement, 94%. C-R at 512 cps is 40 db.; B-C at 2000 cps is 10 db. *B*, audiogram of M. S. made September 1; postoperative results; criterion audition, 21.6 db.

cedures, it is quite evident from this study that, given an effective procedure, comparison can be made only with the degrees of skill used to execute that technique. Thus a comparison of techniques has no meaning unless the influence of the skills required to bring out the best advantages of a given technique can be accurately assessed. This problem introduces a human equation into the calculations with which correlation is extremely erratic. For myself and my colleagues the method of selection discussed here has satisfied the need for an instrument of measure which may be used with a considerable degree of confidence. The accuracy with which audiometry is performed determines the reliability of the predicted result. Any number of surgeons operating with the same technique and on the basis of the same audiometric measurements would very quickly classify themselves in terms of skill. By use of different techniques but still the same audiographic pattern, the relative merits of each of the techniques might be assessed if the degree of skill used in each was known. Consequently, the data acquired in this study apply for one set of conditions only, and the mathematical results cannot be judged accurately with

similar data obtained elsewhere. But the statistical methods may be employed for data obtained from other sources with comparable results.

Since the derivation of this formula, the hearing prognosis of 25 patients has been calculated. In 96% of these the prediction has been correct within ± 5 db.

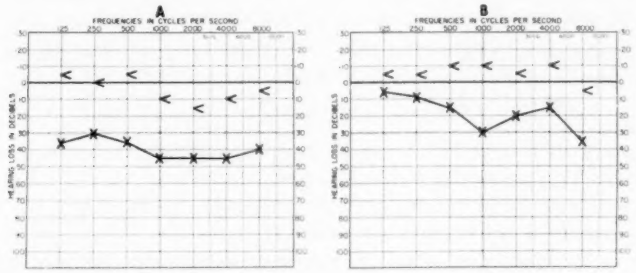

Chart 6.—*A*, audiogram of B. H. aged 37 made May 10, 1950, on audiometer No. W.E.2A; class A pre-operative; criterion audition predicted, 24.35 db.; probability of 30 db. or more hearing improvement, 85%. *B*, audiogram for B. H. made September 13; postoperative results; criterion audition, 21.6 db.

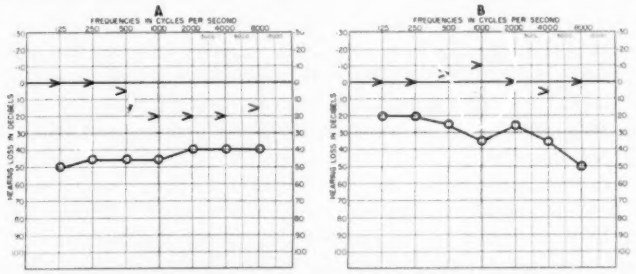

Chart 7.—*A*, audiogram of E. E. aged 23 made July 24, 1950, on audiometer No. W.E.2A; class B pre-operative; criterion audition predicted, 27.3 db; probability of 30 db. or more hearing improvement, 69%. *B*, audiogram of E. E. made August 30; postoperative results; criterion audition, 28.3 db.

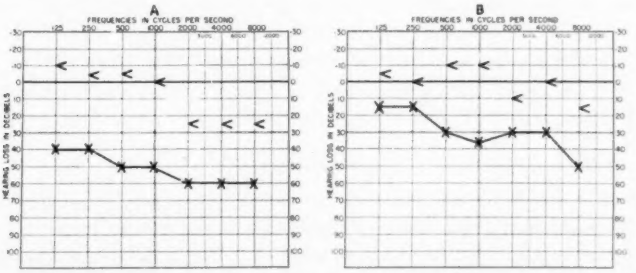

Chart 8.—*A*, audiogram of L. P. aged 31 made July 5, 1950, on audiometer No. W.E.2A.; class B pre-operative; criterion audition predicted, 28.15 db.; probability of 30 db. or more hearing improvement, 63%. *B*, audiogram of L. P. made September 6; postoperative results; criterion audition, 31.6 db.

This is not to say that 96% of these patients achieved hearing levels of 30 db. or better, but it means that, regardless of the postoperative hearing improvement, the thresholds were predicted accurately in 96% of instances.

Charts 5 through 8 demonstrate sample audiograms, taken from the 25 patients' records, which were predicted after the derivation of the prediction formula. It is to be noted that the bone conduction level for 2048 cycles in chart 5*A* is 10 db. The cochlear reserve at 512 cycles is 40 db. These values constitute satisfactory requirements for class A suitability. Criterion audition in this sample may be determined with the prediction formula as follows:

The prediction formula ($X = 0.59x_2 - 0.14x_1 + 21.1$) with the predictive variables substituted for x_1 and x_2, now reads:

$$0.59\ (10) - 0.14\ (40) + 21.1 = 21.4 \text{ db. criterion audition.}$$

The prognosis for this patient of achieving hearing of 30 db. or better is approximately 94%. This percentage estimate includes the 50% which will normally fall in the direction of better hearing and the 44% which lies between the predicted criterion audition of 21.4 db. and the critical 30 db. level.

Prior to the completion of this particular phase of study, selection had been based on the audiometric criteria set forth by Lempert and Shambaugh. Those patients considered to be "ideally suitable" and "not suitable" rarely posed the perplexities experienced with attempts to classify the "suitable" or the "borderline." If suitable at all, the question had always been, "How suitable, and to what degree of reliability may rehabilitation be expected?"

Rehabilitation, as stated by Lempert and others, means the reduction of threshold by fenestration surgery to the 30 db. level or less for the frequencies 512, 1024, and 2048 cps.[19] This, of course, is not complete rehabilitation, but the shift in hearing acuity to better than the 30 db. sensation level enables most hard of hearing persons to hear adequately in the usual noisy environments which generally prevail. It was noted in this study as in others that a shift of the bone conduction thresholds to better levels occurs after successful fenestration surgery.[20] Were it possible to determine the exact causes for this and to anticipate the magnitude of the improvement in any instance, the extent of increase in postoperative air conduction hearing for the principal frequencies could be more accurately estimated.

Despite the reduction of the hearing threshold following fenestration surgery, it is obvious that those who receive the most gain in hearing are more appreciative than those who receive the least, even though the final hearing level reaches or exceeds 30 db. for the frequencies of 512, 1024, and 2048 cps in all instances. This observation, which is not new, and the frequent query, "How good will my hearing be after the operation?" prompted the effort to search for a method which might, in part at least, give some indication of predictability.

CONCLUSIONS

Soon after this study was initiated the first objective rapidly merged with the third as the goal became more clearly defined. The investigations led almost directly to considerations more or less firmly established by the audiometric data obtained. The prospects of determining a unit of measure for comparing the merits of surgical

19. Lemjert, J.: Lempert Fenestra Nov-Ovalis with Mobile Stopple, Arch. Otolaryng. **41**:1-41 (Jan.) 1945.

20. Juers, A. L.: Observations on Bone Conduction in Fenestration Cases: Physiological Considerations, Ann. Otol., Rhin. & Laryng. **57**:28-40, 1948.

techniques and postoperative procedures, other than the one combination used, faded with the accumulation of evidence to the contrary. The second objective dealt with the influence of age, sex, and occupation on criterion hearing. These were eventually disregarded as factors essentially unrelated to the fundamental purpose of the study. Otoscopic inspections failed to reveal evidence of reliable value. Certain features of the audiometric pattern, however, were significantly outstanding. By using the audiometric results of the subject 69 patients as a spring board a prediction equation was developed which yields predictions at a high level of confidence. The value of this method of prediction has been tested in 25 instances with 96% accuracy. The prediction equation derived is directly applicable only to the data obtained with the facilities and under conditions prevailing in the organization of the author. However, the method of arriving at such an equation may be applied to data obtained from other sources and a comparable formula may be derived to aid in the selection and prediction of patients for fenestration surgery.

Advice and guidance were given by James F. Curtis, Ph.D., Associate Professor, Department of Speech, and C. M. Hanley, M.S., and by Scott N. Reger, Ph.D., Research Associate Professor, Department of Otolaryngology, who, in addition to giving valuable assistance, conducted the audiometric measurements.

TUMORS OF THE GLOMUS JUGULARE NOT ASSOCIATED WITH THE JUGULAR VEIN

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AND
JOHN LOUZAN, M.D.
WASHINGTON, D. C.

DURING the past six years the term glomus jugulare has been employed with increasing frequency to designate certain tumors of the middle ear arising from small vascular bodies normally found in the adventitia of the jugular vein near the ramus tympanicus of the ninth cranial nerve. Anatomical descriptions of the structures of the middle ear found in the earlier literature [1] are controversial and leave considerable doubt as to whether aggregates of peripheral ganglion cells or the bodies now known as the glomus jugulare were being described. Credit for the discovery of the normal glomus jugulare should go to Guild,[2] who, in 1941, gave the first adequate description of these formations which are histologically identical with the carotid bodies and other nonchromaffin paragangliomas found elsewhere in the body.[3]

REVIEW OF LITERATURE

Four years after publication of Guild's discovery, Rosenwasser [4] reported a tumor of the middle ear and recognized its resemblance to the glomus jugulare. Since that time, the number of reported cases has risen to 42. In 1947, Kipkie [5] recorded the first simultaneous nonchromaffin tumors of the carotid body and the glomus jugulare, and LeCompte, Sommers, and Lathrop [6] described a tumor of carotid-body type arising in the middle ear. Winship, Klopp, and Jenkins [7] pub-

From the Department of Pathology and the Department of Otolaryngology, Episcopal Eye, Ear, and Throat Hospital.

1. Valentin, G.: Über eine gangliose Anschwellung in der Jacobsonschen Anastomose des Menschen, Arch. Anat. u. Physiol. **287**:290, 1840. Krause, W.: Die Glandula tympanica des Menschen, Zentralbl. med. Wissensch. **16**:737, 1878. Watzka, M.: Paraganglion Tympanicum, Anat. An. **74**:241, 1932.

2. Guild, S. R.: A Hitherto Unrecognized Structure, the Glomus Jugularis, in Man, Anat. Rec. (Supp. 2) **79**:28, 1941.

3. Lattes, R.: Nonchromaffin Paraganglioma of Ganglion Nodosum, Carotid Body, and Aortic-Arch Bodies, Cancer **3**:667, 1950.

4. Rosenwasser, H.: Carotid Body Tumor of the Middle Ear and Mastoid, Arch. Otolaryng. **41**:64 (Jan.) 1945.

5. Kipkie, G. F.: Simultaneous Chromaffin Tumors of the Carotid Body and the Glomus Jugularis, Arch. Path. **44**:113 (Aug.) 1947.

6. LeCompte, P. M.; Sommers, S. C., and Lathrop, F. D.: Tumor of Carotid Body Type Arising in the Middle Ear, Arch. Path. **44**:78 (July) 1947.

7. Winship, T.: Klopp, C. T., and Jenkins, W. H.: Glomus-Jugularis Tumors, Cancer **1**:441, 1948.

lished data on two cases in 1948. One of the patients was living and well 17 years after therapy. The other patient had a tumor of the glomus jugulare which destroyed adjacent bone, involved several homolateral cranial nerves, and metastasized to a cervical lymph node. This is the first reported case in which metastasis was proved. These authors reviewed tissue on cases previously reported as endotheliomas or hemangioendotheliomas [8] and, in this manner, established the existence of six additional cases. In 1949, Fuller [9] described the case of a young woman with neurological symptoms and evidence of bone involvement secondary to a glomus-jugulare tumor. Lundgren [10] added four cases and reviewed tissue from nine patients who had previous diagnoses of angiomas, hemangioendotheliomas, or endotheliomas. Lattes and Waltner [11] reported eight new cases, including one in which there was liver metastasis, and reviewed the literature. They pointed out that the bodies named by Guild glomus jugularis should be called glomus jugulare, a term which seems to be the most satisfactory for the structures and the resultant tumors. DeLisa [12] added one case to the literature in 1950, and Berg [13] published data on five cases, four of which had been published by Lundgren. In his review of the literature, Berg found numerous other cases which might have been included in the category of glomus-jugulare tumors. Several of these had been included in the probable category by other authors, but tissue was not available for study. In the same year, Bartels [14] published an exhaustive study, "De tumoren van het glomus jugulare." In addition to a complete review of the subject, he reported seven of his own cases and discussed 15 others. Five of the latter had been reported previously, and four do not appear to be proved tumors of the glomus jugulare; therefore, he may be credited with 13 cases, the largest series yet published. Bartels convincingly demonstrated the remarkable familial tendency of glomus-jugulare tumors and their frequent association with carotid-body tumors. In his series, seven members of one family, in three generations, had a tumor of the glomus jugulare, a tumor of the carotid body, or both. Winship, Klopp, and Jenkins had listed previously as probable cases of glomus jugulare tumors those of three sisters reported by Goekoop.[15] Bartels reviewed the tissues on these patients and confirmed the diagnosis. All three patients died of their disease. Bartels also referred to three sisters reported by Wassink,[16] who probably had glomus-jugulare tumors. In 1951, Dockerty, Love, and Patton [17] described a case which simulated

8. Capps, F. C. W.: Two Cases of Hemangio-Endothelioma of the Middle Ear, J. Laryng. & Otol. **59**:342, 1944. Proctor, B., and Lindsay, J. R.: Tumors Involving the Petrous Pyramid of the Temporal Bone, Arch. Otolaryng. **46**:180 (Aug.) 1947.

9. Fuller, R. H.: Tumor of the Glomus Jugularis, Naval Med. Bull. **49**:1141, 1950.

10. Lundgren, N.: Tympanic Body Tumours in the Middle Ear, Acta otolaryng. **37**:367, 1949.

11. Lattes, R., and Waltner, J. G.: Nonchromaffin Paraganglioma of the Middle Ear, Cancer **2**:447, 1949.

12. DeLisa, D. A.: Tumor of the Glomus Jugularis, Arch. Otolaryng. **51**:925 (June) 1950.

13. Berg, N. O.: Tumours Arising from the Tympanic Gland (Glomus Jugularis) and Their Differential Diagnosis, Acta path. et microbiol. scandinav. **27**:194, 1950.

14. Bartels, J.: De tumoren van het glomus jugulare, Thesis, Groningen, Holland, 1949.

15. Goekoop, C.: Fibro-Haemangiom des Felsenbeines und des Mittelohres bei drei Schwestern, Acta oto-laryng. **18**:153, 1932.

16. Wassink, cited by Bartels.[14]

17. Dockerty, M. B.; Love, J. G., and Patton, M. M.: Nonchromaffin Paraganglioma of the Middle Ear: Report of a Case in Which the Clinical Aspects Were Those of a Brain Tumor, Proc. Staff Meet., Mayo Clin. **26**:25, 1951.

one of primary brain tumor. Lewis and Grant [18] reported two additional proved cases of glomus-jugulare tumor, one of which improved after a small amount of irradiation therapy. Poppen and Riemenschneider [19] described two cases, one of which has been discussed in previous publications.[20] In their second patient, there was apparently no ear tumor, and the gross description is not clear enough to justify an opinion concerning the nature of the tumor.

RECENT ANATOMICAL DISCOVERIES

Guild [21] continued his anatomical investigation of the middle ear and announced recently that the structures now known as glomus jugulare are not as restricted in their location as had been thought previously. He writes:

> The main points of clinical and surgical interest concerning the glomus jugulare that have been revealed by the additional study of normal material since the first report in 1941 are: (1) These structures occur not only along the nerve of Jacobson (tympanic branch of the glossopharyngeal) but also, and about as frequently, along the course of the nerve of Arnold (auricular branch of the vagus). (2) Slightly more than half of them are in the adventitia of the dome of the jugular bulb. (3) Along the nerve of Jacobson a glomus formation may be present, distal to its promontorial part, in the region where the nerve becomes continuous with the lesser superficial petrosal nerve near the geniculate ganglion of the seventh cranial nerve. (4) Along the nerve of Arnold a glomus formation may be present, at least as far distally as the crossing of the mastoid canaliculus and the descending part of the facial canal. (5) The observed normal variations in the location of glomus formations are sufficient to account for all of the differences that have been reported in patients with glomus jugulare tumors and for the differences in apparent origin that have been found at operation.

On the basis of Guild's original findings, a tumor of the middle ear arising at the site of the promontory was difficult to explain. The following case is of interest in view of Guild's recent discovery, since the tumor had its origin in the promontory of the middle ear proper.

REPORT OF A CASE

L. C., a 51-yr.-old woman, was first seen on Jan. 8, 1951, complaining of a tumor in the left ear. The patient had consulted a physician in 1944 because of itching and impaired hearing in the left ear. She was advised at that time that she had a polyp in the ear, but she received no treatment. She did not seek medical advice again until 1948. At that time the mass had grown larger, but it did not yet protrude from the external canal. Roentgenograms at that time showed a "sclerotic mastoid" with haziness of the cells of the left side. The taking of a biopsy of the polyp, at another hospital, resulted in considerable bleeding, and a pathological diagnosis of hemangioma was made.

She was admitted to the Episcopal Eye, Ear, and Throat Hospital, Washington, D. C., on Jan. 17, 1951, where physical examination revealed a painless, vascular, purplish mass completely filling the ear canal and protruding from the external auditory meatus about 1 cm. There was a definite weakness of the left facial muscles, and the patient's hearing was zero for conversational voices. A radical mastoidectomy was performed through a postauricular approach, and the mass was found to be occupying the upper third of the mastoid and the entire middle ear. There was no perforation or other abnormality of the floor of the middle ear. There

18. Lewis, J. S., and Grant, R. N.: Nonchromaffin Paraganglioma of the Middle Ear (Glomus Jugulare Tumor), A. M. A. Arch. Otolaryng. **53**:406 (April) 1951.

19. Poppen, J. L., and Riemenschneider, P. A.: Tumors of Carotid Body Type Presumably Arising from the Glomus Jugularis, A. M. A. Arch. Otolaryng. **53**:453 (April) 1951.

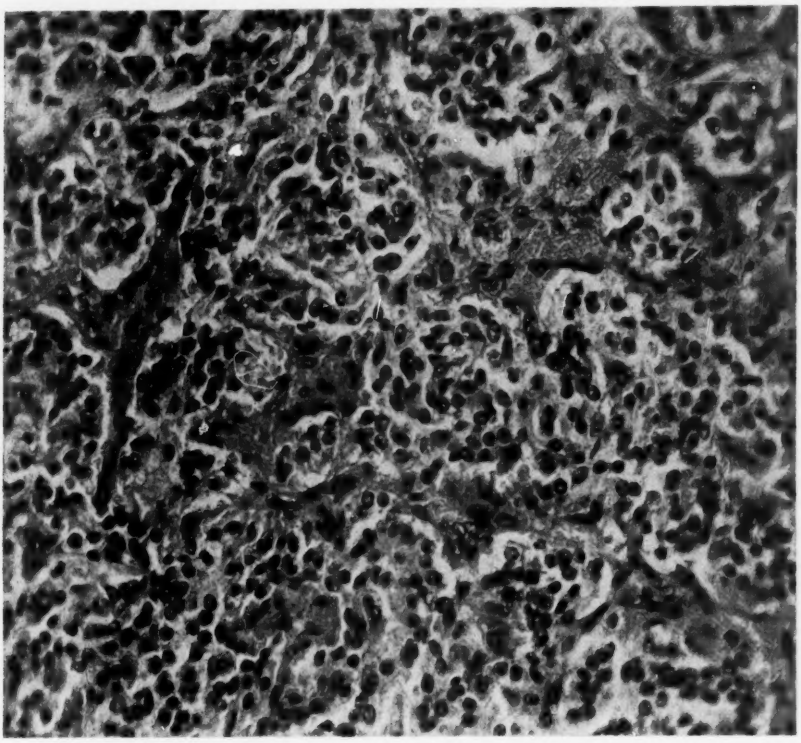
20. Kipkie.[5] Winship, Klopp, and Jenkins.[7]

21. Guild, S. R.: Personal communication to the authors.

was only a moderate amount of hemorrhage throughout the procedure. The operative wound was packed, the packing being removed on the fifth postoperative day with only slight bleeding. The patient made a very satisfactory recovery. The facial weakness gradually disappeared, and six months after the operation there was no evidence of recurrence.

CLINICAL OBSERVATIONS

The histories of the reported cases show remarkable similarities. They usually include progressive loss of hearing, a vascular polyp, and chronic otorrhea; as the tumor enlarges and erodes adjacent structures, pain with paralysis of cranial nerves may be present.



Glomus-jugulare tumor, showing the characteristic alveolar pattern and the rich vascularity of the septums.

The nature of tumors of the glomus jugulare is such that few alarming symptoms occur until late, when complete removal is difficult or impossible. Hemorrhage at the time of the operation may be profuse and is usually difficult to control. The vascularity of the tumor, as seen in the figure, explains the frequency of hemorrhage. Digital compression of the external carotid artery probably would reduce the bleeding, since the glomus jugulare is supplied by its ascending pharyngeal branch.

Complete excision of the tumor is necessary, for benign and malignant tumors of this type are grossly indistinguishable, and the first operative procedure offers the best, and possibly the only, chance for a cure.

The data from the reported cases are not sufficient to permit definite evaluation of irradiation therapy in this type of tumor, but in one of the cases previously reported from the Episcopal Eye, Ear, and Throat Hospital enough irradiation

Published Cases of Glomus-Jugulare Tumors

	Contributor	Year	Sex	Age	Treatment	Follow-Up
1.	Rosenwasser	1945	M	36	Surgery	Living and well 2 yr.
2.	LeCompte, Sommers, and Lathrop	1947	F	43	Surgery	Living and well 1 yr.
3.	Kipkie	1947	F	29	Surgery	Died 10 yr. postoperatively
4.	Capps	1948	F	49	Surgery	Living with disease 7 yr.
5.	Capps	1948	F	51	Surgery	Living with disease 9 yr.
6.	Capps	1948	F	52	Surgery	Living and well 4 yr.
7.	Proctor and Lindsay	1948	F	55	Surgery	Died 9 yr. postoperatively
8.	Winship, Klopp, and Jenkins	1948	F	54	Biopsy of node; x-ray; radium	Living with disease 16 yr.
9.	Winship, Klopp, and Jenkins	1948	M	64	Surgery; radium	Living and well 19 yr.
10.	Fuller	1949	F	24	Surgery	.....
11.	Lundgren	1949	F	62	Surgery	Living and well 6 yr.
12.	Lundgren	1949	F	48	Surgery	Living and well 2½ yr.
13.	Lundgren	1949	F	43	Surgery	Living and well 1 yr.
14.	Lundgren	1949	M	44	Surgery	Living and well 6 mo.
15.	Lattes and Waltner	1949	F	60	Surgery	Living with disease 2 yr.
16.	Lattes and Waltner	1949	F	71	Biopsy; x-ray	Died 20 mo. postoperatively
17.	Lattes and Waltner	1949	F	23	Surgery; x-ray	Living and well 6 yr.
18.	Lattes and Waltner	1949	F	77	Surgery	Died 2½ yr. postoperatively
19.	Lattes and Waltner	1949	F	38	Surgery	Living and well 3 yr.
20.	Lattes and Waltner	1949	F	30	Surgery; x-ray	Living and well 2½ yr.
21.	Lattes and Waltner	1949	F	47	Surgery	.....
22.	Lattes and Waltner	1949	M	40	Surgery; x-ray	Died 2 mo. postoperatively
23.	DeLisa	1950	F	64	Surgery	.....
24.	Berg	1950	F	54	Surgery	Living and well 6 mo.
25.	Bartels	1950	F	58	Surgery	Died 4 days postoperatively
26.	Bartels	1950	M	21	Surgery; radium; x-ray	Living and well 10 yr.
27.	Bartels	1950	M	58	.....	.....
28.	Bartels	1950	F	29	Surgery	Died
29.	Bartels	1950	F	19	Surgery	Died
30.	Bartels	1950	F	19	Surgery	Died
31.	Bartels	1950	F	19	None	Died
32.	Bartels	1950	M	32	Surgery; radium	Living and well 1 yr.
33.	Bartels	1950	F	37	Surgery; x-ray	.....
34.	Bartels	1950	F	30	Surgery; radium	.....
35.	Bartels	1950	M	40	Surgery	.....
36.	Bartels	1950	F	45	Surgery; radium	Living and well 1 yr.
37.	Bartels	1950	F	44	Surgery	Living and well 1 yr.
38.	Dockerty, Love, and Patton	1951	F	52	Surgery	Died 8 days postoperatively
39.	Lewis and Grant	1951	F	63	Surgery	Living and well 7 mo.
40.	Lewis and Grant	1951	F	80	Biopsy; x-ray	Living and well 3½ yr.
41.	Poppen and Riemenschneider	1951	F	26	Surgery; x-ray	Died 4 yr. postoperatively
42.	Winship and Louzan	1951	F	51	Surgery	Living and well 6 mo.

therapy had been given to establish the radioresistant nature of the tumor. It is generally believed that the closely related carotid body tumors do not respond to irradiation.

Microscopically, all tumors of the glomus jugulare have the same basic pattern. They are composed of nests of large, clear cells with vesicular nuclei and eosinophilic cytoplasm. The cells are arranged in an alveolar pattern, separated by extremely vascular, thin, fibrous septa. Mitoses are uncommon, even in the tumors which show invasion and metastases.

The table lists 42 reported cases of glomus-jugulare tumor in which tissue was examined since Guild's discovery in 1941. Many other cases have been reviewed and considered as probable tumors of the glomus jugulare, but adequate histological proof is lacking.

The data from this series show that 80% of the tumors occurred in women. No cases of bilateral glomus-jugulare tumors have been reported, but in four instances carotid-body tumors have occurred concurrently. The average age of the patients at the time pathological diagnosis was established was 43.8 years. Many of the patients have been followed for long periods, and the average follow-up for the series was four years.

The methods of therapy were extremely variable. Twenty-seven of the patients were treated by surgery only, and in 12 either x-ray or a combination of x-ray and radium treatment supplemented the surgery.

The prognosis for patients with tumors of the glomus jugulare is not good. Of the 35 patients in this series who were followed, 12 have died either directly or indirectly of their disease. It is impossible to determine with certainty the number of patients living with disease, but four are known at the time of this report.

SUMMARY

A case of glomus-jugulare tumor is presented. This tumor arose from the promontory and had no relation to the dome of the jugular bulb. The origin is explained by recent anatomical discoveries of Guild.

The literature on glomus-jugulare tumors has been reviewed, and a total of 42 cases has been collected.

Glomus-jugulare tumors show strong familial tendencies, and, frequently, concurrent carotid-body tumors occur in the affected patient or in his family.

The mortality rate for the present series of patients was 34%, and 80% of the tumors occurred in women.

POSTOPERATIVE NASAL BLEEDING

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AND
WILSON A. SWANKER, M.D.
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FEW MEDICAL catastrophies engender more concern than a simple attack of epistaxis. When the onset is in the postoperative period, the apprehensiveness is increased. Instances of postoperative nasal hemorrhage of any magnitude are comparatively rare, considering the frequency of operative procedures upon the nose. The seriousness of this complication when it does occur, however, warrants thorough consideration by those who do nasal surgery. It is necessary to be confronted by only a single case of profuse postoperative nasal bleeding to realize the gravity of this problem. A specific type of standard procedure for management of such cases should be kept in mind to be applied when these emergencies arise. This procedure should be made a part of the intern-training program, for a good result in rhinoplasty is not infrequently jeopardized by an intern's overzealous packing. Furthermore, improper packing and the attendant manipulation may increase the bleeding.

There are three types of nasal hemorrhage. Primary hemorrhage, which occurs at the time of surgery, can usually be controlled at the moment. Secondary hemorrhage occurs in the first 24 to 48 hours. This is usually controlled by anterior repacking, application of ice to the nose, and/or administration of anticoagulants. Delayed hemorrhage, that which breaks out after the packing has been removed, usually on the sixth to eighth postoperative day, is the type which causes most concern. This is the hemorrhage about which most of this paper is concerned.

The popularity of rhinoplastic surgery, performed by both otorhinolaryngologists and plastic surgeons, stimulated us to give this subject unequivocal study.

BLOOD SUPPLY OF THE NOSE

An exhaustive review of the basic vascular anatomy of the head and neck emphasizes the profuse anastomoses between the branches of the external and the internal carotid arteries. Of particular interest, at this time, are those in the region of the nose (Fig. 1). The major blood supply of the nose stems from the external carotid artery, although the internal recesses of the nose receive much of their supply from the internal carotid artery.

The important arteries of the external nose are (1) branches of the external maxillary (facial) artery (the fourth branch of the external carotid); (2) the infraorbital artery, which is a branch of the internal maxillary artery (the ninth branch of the external carotid), and (3) the ophthalmic artery (the second branch

From the Plastic Surgery Service, Department of Surgery, New York Medical College, Flower and Fifth Avenue Hospitals.

of the internal carotid artery). The arteries of the internal nose are (1) the arteries of the septum from the external maxillary artery, (2) the sphenopalatine and the descending palatine arteries (branches of the internal maxillary), and (3) the anterior and posterior ethmoidal arteries (branches of the ophthalmic branch of the internal carotid artery).

The lateral nasal artery is derived from the facial (angular) artery as it ascends along the side of the nasolabial junction near the nasolabial fold. It supplies the ala and the dorsum of the nasal tip as it anastomoses with its fellow of the opposite side. It also anastomoses with the nasal branch of the ophthalmic artery, the inferior artery of the septum, the artery of the ala, and the infraorbital artery.

The inferior artery of the septum and the artery of the ala are branches of the superior labial coronary artery. The inferior artery of the septum ascends beneath the philtrum on each side. It ramifies over the lower portion of the septum and to

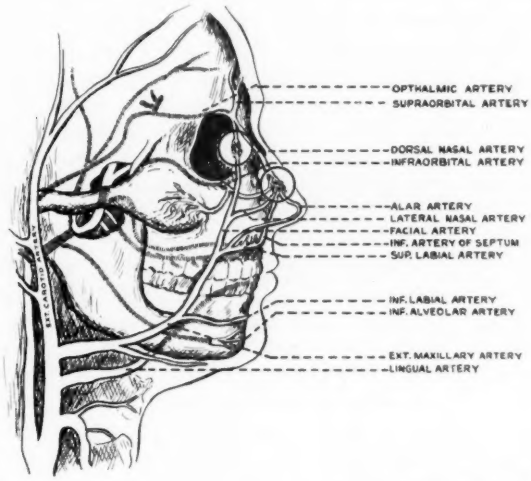

Fig. 1.—Circles indicate two main anastomoses between the external and internal carotid arteries. A third and deeper anastomosis occurs in the middle third of the nasal septum.

the tip of the nose, supplying the septum and the columella. The common practice among laymen of applying pressure over the upper lip for nose bleed is for compression of these ascending branches, which will obviously control bleeding only from this limited region.

The artery of the ala supplies the ala of the nose. The profuse anastomosis of each of these vessels with its fellow, with one another, and with the internal carotid through the ophthalmic artery, affords the nasal tip region a considerable supply of blood.

The sphenopalatine artery is derived from the infraorbital artery. It passes through the sphenopalatine foramen into the nasal cavity at the posterior portion of the superior meatus, where it divides into several branches.

The nasopalatine artery of the septum courses obliquely downward and forward along the septum and supplies the mucous membrane. It anastomoses anteriorly

with the terminal branches of the ascending palatine branch of the facial artery. Several smaller branches of the sphenopalatine go to the lateral nasal wall, the antrum, and the ethmoidal and sphenoidal cells.

The angular artery is the termination of the facial artery. It ascends along the side of the nose to the inner canthus of the eye embedded in the fibers of the levator labii superioris alaeque nasi muscle and anastomoses with the nasal branch of the ophthalmic artery (a branch of the internal carotid artery). The angular artery gives off branches along its course to the adjacent tissues of the cheek and the side of the nose. It then goes on to supply the lacrimal sac and the levator palpebrae muscle. It is accompanied by its corresponding vein, the angular, which is quite large. It communicates with the ophthalmic vein and thus establishes an important anastomosis between the facial vein and the cavernous sinus. While the angular artery is not usually included in textbook descriptions of the blood supply of the nose, it and its vein are, nevertheless, of importance to the rhinoplastic surgeon. Both hemorrhage and cavernous sinus disturbance may be caused by severance of either of these vessels.

The blood supply from the internal carotid artery is mainly to the external nose from branches of the ophthalmic artery. The dorsal nasal artery, a terminal branch of the ophthalmic artery, emerges from the orbit above the tendo oculi. After it has given a branch to the lacrimal sac, it divides into the transverse nasal artery and the dorsal nasal branch. The transverse nasal artery anastomoses with the angular artery. The dorsal nasal branch runs along the dorsum of the nose, supplying its outer surface, and anastomoses with its fellow of the opposite side and with the lateral nasal branch of the facial (from the external carotid artery).

The anterior ethmoidal artery, a branch of the ophthalmic, accompanies the nasal nerve through the anterior ethmoidal foramen, supplying the anterior ethmoidal cells and the frontal sinus. It then enters the cranium, gives off a dural branch and nasal branches which descend into the nose through a slit at the side of the crista galli, and runs along the groove on the under surface of the nasal bone, thus supplying the skin of the nose in this area.

The posterior ethmoidal artery, also a branch of the ophthalmic artery, passes through the posterior ethmoidal foramen and supplies the posterior ethmoidal cells. It enters the cranium, where it gives off a dural branch and nasal branches which descend into the nose through apertures in the cribriform plate and anastomose with branches of the sphenopalatine artery (from the external carotid artery).

The veins, in general, accompany the arteries, and then they form extensive plexuses, quite superficially, under the mucous membrane. The veins accompanying the sphenopalatine artery empty into the pterygoid plexus. Those associated with the ethmoidal arteries empty into the ophthalmic vein. Some pass through the foramens of the nasal bones and the nasal process of the maxilla to empty into the facial vein. Others pass through the foramen caecum to the superficial longitudinal sinus and through the cribiform plate to join the intracranial veins. The angular vein is large. It arises at the junction of the frontal and the supraorbital veins. It runs obliquely downward and outward along the root of the nose to the lower margin of the orbit, where it becomes the facial vein. It receives the veins of the ala nasi on its inner side and communicates with the ophthalmic vein through the completing of an anastomosis with the facial vein and the cavernous sinus.

An appraisal of this profuse blood supply, from a practical point, suggests the following facts: 1. Because of so profuse a blood supply, the possibility of immediate, secondary, or delayed hemorrhage is pronounced following any intranasal surgery. 2. Because of this profuse blood supply, infection is rarely expected. 3. Such a blood supply enhances healing. 4. The control of hemorrhage by ligation of the external carotid artery alone is not adequate. The internal carotid artery cannot be ligated safely without cerebral complications. The common carotid artery should never be ligated for nasal hemorrhage, as the imminent risk of permanent cerebral damage is not warranted.

GENERAL PROPHYLAXIS

All precautionary measures that are usually taken to assure good postoperative recovery must be exercised in surgery of the nose. It is unfortunate that nasal surgery has been called minor surgery, for minor surgery seems to suggest the lack of need for thorough, adroit preparation of the patient. As in all other surgery, a carefully taken, complete history and thorough physical examination are essential to the proper appraisal of the patient. It is desirable to elicit any history of trauma or previous nasal surgery. It is well to remember that all patients have a greater

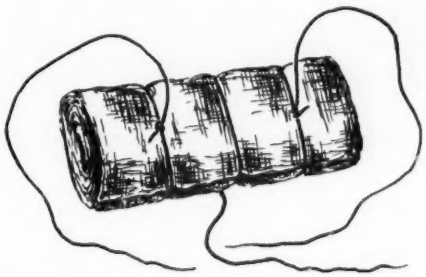

Fig. 2.—Nasal pack with three strings.

tendency to bleed in warm weather. This may be caused by the vasodilatation that occurs at this time. These observations should be made with factors of bleeding in mind: (1) the amount of bleeding from any recent injury; (2) the menstrual history, since women bleed more during menses; (3) the bleeding and/or coagulation times, and (4) other laboratory findings, such as urinalysis, and complete blood count.

The use of coagulants such as "koagamin" (a hemostatic containing oxalic and malonic acid) and vitamin K, preoperatively when the history suggests it and postoperatively as an adjunct to local measures, will be of benefit. The use of morphine sulfate will allay much of the apprehension. However, it is dangerous to have the patient too well narcotized, lest bleeding occur of which the patient is not cognizant. A patient can swallow a large amount of blood in a relatively short time.

During the operation, the bleeding can be minimized in several ways. The use of epinephrine in the anesthetic solution will avert much bleeding. The practice of keeping the nostril packed full on the side not involved in the immediate procedure is helpful. The free use of packing strips soaked in epinephrine solution during the surgery will allay much of the ooze. If the operator is careful to keep close to the

bone subperiosteally when elevating the soft tissues, no large vessels will be severed. It is well to remember that the arteries of the nose contract rapidly if they are severed. There is no possibility of using a hemostat. Whenever the nose is packed, either during or after the surgery, it has been found that dry gauze stays in place the best. Careful packing of the nasal cavity after surgery will stay any tendency toward minor bleeding. However, when hemorrhage does occur, a more ambitious method than anterior nasal packing must be employed. This means the use of both anterior and posterior nasal packing. Before any packing is done

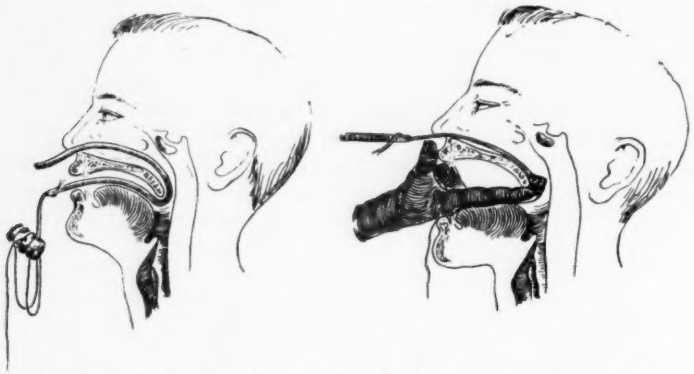

Fig. 3.—Insertion of nasal pack by means of rubber catheter and digital palpation.

Fig. 4.—Nasal pack held in place by taut strings while nasal fossa is packed.

for hemorrhage, an attempt should be made to visualize the area with a bright light. The clots must be removed to ascertain the area of hemorrhage. It may be possible at this time to cauterize a bleeding point. One of the coagulants, absorbable gelatin sponge U. S. P. ("gelfoam") or oxidized cellulose U. S. P. (oxycel®) may be placed over the area and packed in place with the strip packing. This is best done in a hospital or a very well equipped office. It is almost impossible to accomplish it in the home. It is frequently necessary and advisable to readmit the patient for observation and packing. When the patient arrives at the hospital, blood typing should be done. If the hemorrhage has been profuse or of long duration,

blood transfusions should not be delayed longer than the time needed for the emergency laboratory work. It is best to keep the patient's head slightly elevated, at about a 20-degree angle, rather than flat or upright.

Profuse epistaxis is almost always unilateral. If it is of the bilateral type, the two nares can be packed alike. However, only one posterior packing is necessary. If the hemorrhage follows a rhinoplasty, it is well to pack both nasal fossae anteriorly to equalize pressure and maintain alignment of the nose.

We believe that the posterior nasal pack should be made up with three strings rather than the two usually used (Fig. 2). The pack is made of folded gauze. Iodoform gauze may be used; it can be left in place longer, and has the advantage of being antiseptic. Two of the strings are tied to a soft rubber catheter that has been passed through the bleeding nasal fossa into the mouth (Fig. 3). Care must be taken to be sure the pack is seated well up in the nasopharynx against the choanae. This can be assured by digital palpation. The strings are held taut

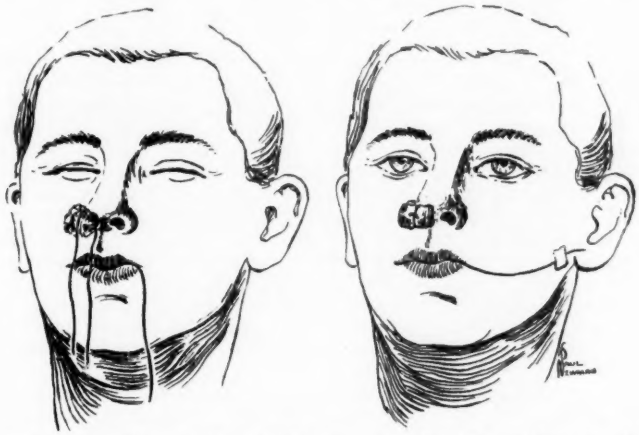

Fig. 5.—Two strings tied to hold packing in place, and the third anchored to the cheek.

anteriorly while dry ½-in. (1 cm.) gauze strips are packed well back against the posterior pack and slowly forward until the entire nasal fossa is packed full (Fig. 4). The excess packing is bunched at the anterior nares, or a small piece of gauze is rolled and placed at this point between the two strings, which are then tied over it to hold it in place (Fig. 5). This final tying makes all the packings an integral unit. The string from the mouth can be anchored to the cheek with a small piece of adhesive tape.

Hemostatics such as absorbable gelatin sponge or oxidized cellulose may be used as adjuncts to the packing described. However, in general, this is not routinely necessary over bleeding areas.

SUMMARY

A method of nasal packing for postoperative nasal hemorrhage is described which we feel is almost positive in its control of the hemorrhage.

The blood supply of the nose is discussed in an attempt to prove that ligation of the carotid arteries is not satisfactory or necessary.

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LYMPHOEPITHELIOMA OF THE NASOPHARYNX

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FOUR CASES of lymphoepithelioma of the nasopharynx have been observed recently by me. These cases demonstrate interesting and typical features which make their presentation worth while together with a discussion of the entire problem of these anaplastic neoplasms.

REPORT OF CASES

CASE 1.—S. C., a Negro woman aged 32, first appeared on June 28, 1948, in the Medical Outpatient Department with a history of loss of weight in the previous months and stuffiness of the nose. After examination, which revealed no abnormal physical findings, she was referred to the allergy clinic on July 2 for further study. Here, also, the findings were negative. On Aug. 24, in the dental clinic, extraction of the second and third lower left molar teeth was followed by copious hemorrhage and syncope. The bleeding continued and the face became considerably swollen, necessitating hospitalization on the following day. On Aug. 26, while in the hospital, she had an attack of epistaxis, and the nose was packed by the intern. She was seen subsequently by my colleagues and me in consultation. At the time of our examination there was no active bleeding point visible in the nose, and the predominant condition was the painful swelling of the left side of the face.

The patient gave the history of the extractions two days previously followed by severe bleeding, syncope, and swelling of the face, and also of fever and nosebleed from the left side. She also complained of stuffy nose of several months' duration and of two previous attacks of nosebleed.

On examination, the patient, well developed but poorly nourished, appeared very ill. There was brawny swelling of the entire left side of the face extending to the left submaxillary area. The left eyelids showed edema. The swelling was tender. She wore dark glasses to protect the left eye, which was tearing. The pupils reacted normally, but the left eye showed some photophobia. The nasal cavity contained mucopurulent secretion on both sides, and the mucous membrane was congested. Painful trismus during attempts to open the mouth was the only significant evidence that her condition was the result of the recent extractions. Physical and laboratory findings were noncontributory.

The patient had had seven pregnancies, but only three children were alive, aged 11, 9, and 7. No previous serious illnesses were reported. The family history was not pertinent.

Our diagnosis was cellulitis of the face, secondary to postextraction infection and chronic pansinusitis. Roentgenograms of the paranasal sinuses were ordered, and it was requested that the patient be referred to the ear, nose, and throat clinic for further investigation and treatment. Under penicillin and sulfadiazine therapy the cellulitis resolved, and the patient left the hospital on Sept. 17. Roentgenograms of the paranasal sinuses revealed bilateral cloudy ethmoids and cloudy left antrum.

On Oct. 18 she appeared in the clinic for antrum irrigation. On examination, there was seen edema of the left lower lid and tearing from this eye. There were a few small nodes in the submaxillary and upper deep cervical areas which did not appear significant. In the nose there was mucopurulent secretion in both middle meatuses, and the mucous membrane was red. On

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the left side, protruding from the inferior meatus and extending back along the medial aspect to about the middle of the turbinate, was a small dark-red soft granular-appearing and easily bleeding mass. Antrum puncture was not done as contemplated, but a biopsy specimen was taken with punch forceps. The sections showed malignant lymphocytoma. In view of the site of the tumor mass, the infraorbital swelling, and the roentgen appearances, the diganosis of malignant tumor of the left antrum was made.

Fig. 1 (Case 1)—Photomicrograph of lymphoepithelioma of the nasopharynx (× 150). Small groups of epitheliomatous cells are scattered in a stroma with dense lymphocytic infiltration.

On Oct. 25 removal of an enlarged lymph node from the left anterior triangle was accomplished. This was found free from evidence of malignancy.

On Nov. 18, at the request of Dr. Isidore Arons, chief of service of the radiation therapy department, the left antrum was opened through the usual Caldwell-Luc canine fossa. Only three mucous polyps were found filling the antrum, with no tumor mass present, and the orbital plate was intact. Radium needles were packed in gauze into the antrum and left in situ for a total of 100 hr. The operation proved that the tumor did not arise from the antrum, and gave the impression that the primary site of the neoplasm was the nasal cavity. The pathological report on specimens taken here was benign polyp. The section at this time did not show the malignant changes seen in the previous section.

An aspiration biopsy specimen from a steadily enlarging left preauricular node contained no tumor cells.

On Dec. 3 a second biopsy specimen was taken from the mass on the inferior turbinate. The report on this was returned with a pathological diagnosis of malignant changes suggestive of epidermoid carcinoma.

On Dec. 13, for the purpose of having the tumor area removed, the patient was readmitted for the third time. Maxillary antrotomy was done through the previous Caldwell-Luc incision

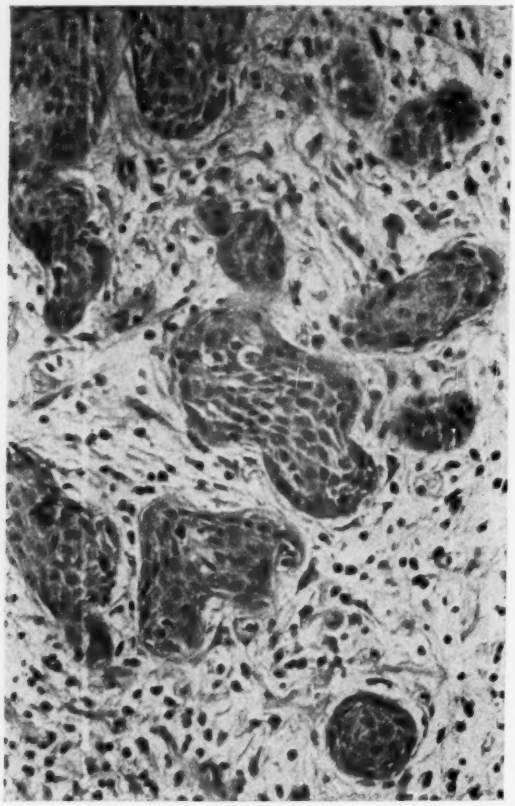

Fig. 2 (Case 1)—Photomicrograph of lymphoepithelioma (× 450). Illustration shows epitheliomatous cells with tendency toward differentiation but no actual perle formation. Here the lymphocytic infiltration is less dense.

and the nasoantral wall was widely excised, including the inferior turbinate. The report on this specimen was that the sections showed a very severe acute inflammatory process in which one could see atypical epithelial cells which resembled the neoplastic cells seen in previous biopsy specimens. The patient continued to complain of severe pain in the left maxillary area and showed edema in the infraorbital area due to lymphatic obstruction.

The following are the apparently contradictory pathological reports on biopsy specimens taken from the same tumor mass on different occasions and giving these successive diagnoses: (1) malignant lymphocytoma; (2) malignant tumor suggestive of epidermoid carcinoma, and (3)

severe acute inflammatory process with atypical epithelial cells resembling neoplastic cells. These prompted the chief of service, Dr. Herman J. Burman, to request a review of the slides of all specimens. A report was returned that a review of the slides Feb. 2, 1949, revealed sarcomatous as well as carcinomatous changes previously described and that the picture was compatible with lymphoepithelioma (Schminke tumor).

The patient was readmitted to the ward for the fourth time, because of a recurrence of swelling, induration, and tenderness at the medial aspect of the orbit and of both eyelids. She

Fig. 3 (Case 1)—Photomicrograph of lymphoepithelioma (× 150) showing sheets of squamous cells interspersed among the cells of the lymphoid tissue.

was in a great deal of pain after a partial course of roentgen therapy and was admitted for continuance of roentgen therapy to the affected areas and also for opening up of the ethmoid cells. Ophthalmologic consultation was requested; it was reported that the right eye was normal in every respect, but that there was ciliary injection in the left eye and limitation of motion laterally. This eye appeared somewhat proptosed and elevated, producing a diplopia when looking straight ahead. There was marked tenderness over the globe; the tension was normal, and the cornea was clear. The pupils reacted well to light. The media were clear and the fundus, disk, and retina showed no pathologic conditions.

On March 2, 1949, external ethmoidectomy was done, but the labyrinth showed no malignant invasion macroscopically or microscopically.

It was obvious that the tumor of the anterior part of the nasal cavity with such an inconstant pathological picture did not represent the original tumor but was definitely metastatic. A search was made in the most usual site. Direct nasopharyngoscopy had shown no abnormalities of the lateral walls of the nasopharynx and choanae. The vault of this area could not be seen through the nasopharyngoscope and examination by mirror had been and was consistently impossible because of trismus.

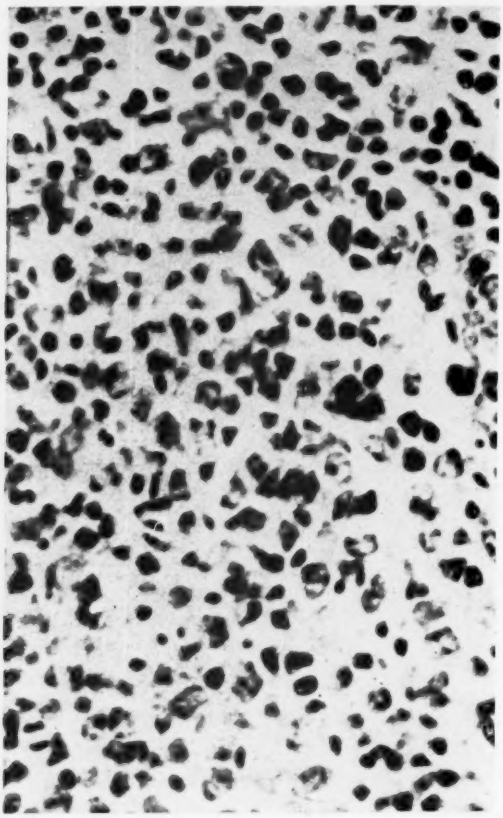

Fig. 4 (Case 1)—Photomicrograph of lymphoepithelioma (× 930) showing numerous large pale-staining tumor cells loosely scattered among the denser lymphoid cells.

On March 30, 1949, a biopsy specimen was obtained with an adenotome, producing a small flat piece of pale granular-appearing tissue, which was sent for pathological examination. This brought back a report of a clear-cut lymphoepithelioma—Schminke tumor. The diagnosis was complete on discovery of the primary tumor in the vault of the nasopharynx.

By Aug. 29 a fistula developed in the left infraorbital area, draining purulent material, the result of osteomyelitis. Penicillin and wet dressings were applied, but the fistula persisted.

Treatment.—Before x-ray therapy was given to the antrum, 8 mg. of radium filtered with 1 mm. Pt was inserted into the antrum and left in place for a 100 mg.-hr. dose. Four fields,

each 2.5 cm. in diameter, were irradiated with the following technical factors: 250 kv., 15 ma., 0.5 mm. Cu filtration, 46 cm. target-skin distance. Two fields were treated daily, and a dose of 250 r. was given to each field. The total dose to each field was 2,400 r. (air) and the total tumor dose 5,700 r.

The nasopharynx was irradiated by a cross fire technique through two lateral fields. The following technical factors were used: 250 kv., 15 ma., 1 mm. Cu plus 1 mm. Al filtration, target-skin distance 46 cm., 5 cm. circular port angled upward 45 degrees. Treatment was given five times a week, one field receiving a dose of 200 r. each treatment day, for a total dose of 2,500 r. to each field.

At present the left preauricular node is completely resolved, and there are no cervical nodular enlargements. There is a wide fistula in the left infraorbital area through which one can see the antral and nasal cavity. There has been some loss of the inferior orbital margin in this area. The patient has been readmitted to the hospital for the purpose of a plastic repair of the fistula. She has gained weight from a low of 105 lb. (47.7 kg.) to 133 lb. (60.4 kg.) and in February, 1951, gave birth to a child. She has had two and one-half years of freedom from recurrence since the start of treatment.

CASE 2.—C. S., a white woman, aged 22, married and with one child, was admitted to the hospital on April 1, 1949, with the history of experiencing a sharp pain in the right knee and falling on a slippery street while running for a bus. Roentgenogram revealed a comminuted fracture involving the distal end of the articulating margin of the right femur medially. A large bone fragment had been displaced moderately; the fracture line entered the knee joint. There was marked clouding of the joint space. The diagnosis was pathological fracture.

In November, 1948, a tumor had developed behind her eye and the back of the nose. The eye had become "swollen" and was tearing. The patient had received roentgen therapy up to January, 1949, at another hospital. The diagnosis at that time was lymphoepithelioma of the nasopharynx with metastases.

On examination, the patient showed generalized metastases. In the outer lower quadrant of the right breast there was a hard nodular adherent mass about the size of an egg. There was a scar of a previous biopsy. A hard node was observed on each side in the scapular areas, and there were enlarged hard nodes in both submaxillary areas and also in the axilla.

The Kahn reaction of the blood was negative, and results of blood chemistry studies and the blood count were essentially normal. A roentgenogram of the skull in the lateral position only showed no evidence of neoplastic change or other pathologic condition. Other bones showed no neoplastic invasion.

On April 8, 1949, biopsy of the right scapular region produced a report of metastatic lymphoepithelioma. (Lymphosarcomatous elements were predominant in this specimen.) The patient was given only analgesics in the form of methadone (dolophine®) hydrochloride and aminopterin (4-aminopteroylglutamic acid). The patient signed out on her own responsibility on April 16, 1950, and subsequently attempted suicide at home.

CASE 3.—E. R., a Negro girl, aged 17, was admitted to the hospital Dec. 17, 1949, with the history of a swelling on the left side of the neck. This had grown progressively larger since the onset, one month previously, and was intermittently painful. She did not complain of a loss in weight, and had had no previous serious illnesses.

On examination, there was a hard slightly tender smooth mass about the size of an egg and roughly 8 cm. in diameter on the right side of the neck, extending from behind the angle of the mandible to the submaxillary area. There were also smaller nodes on the left side, one about 2 cm. in diameter at the angle of the mandible and another, about 3 cm., at the same level in the posterior triangle.

The results of blood serologic tests were as follows: Mazzini test, 4+; Kolmer test, 4+. The results of other laboratory tests were normal.

She later complained of headaches and of pain in the right side of the face and in the left shoulder. While in the hospital, the patient experienced two attacks of epistaxis and admitted that she had three previous episodes in the previous month. An enlarged node also developed in the right popliteal region.

The nodes continued to enlarge progressively, and a biopsy specimen was taken from the mass on the right side on Jan. 7, 1950. The pathological report subsequently received was lymphoepithelioma (Schminke tumor). The patient was referred to the radiation therapy department, and roentgen therapy was started on Jan. 30, 1950, according to the following plan:

1. Four fields were irradiated with 250 kv., 15 ma., rays filtered with 1 mm. Al and 0.5 mm. Cu at a target-skin distance of 46 cm. Two fields were treated daily, each receiving 200 r. The total dose to each field was 3,000 r. measured in air.

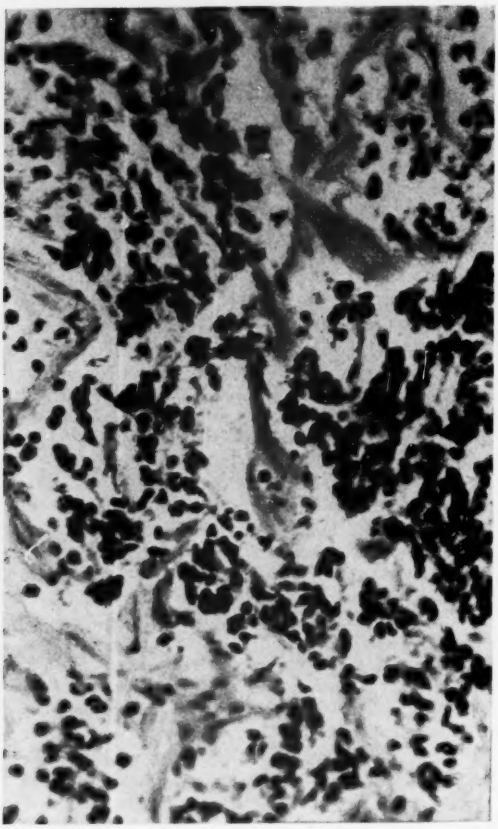

Fig. 5 (Case 2)—Photomicrograph of metastatic lymphoepithelioma (× 450) showing masses of tumor cells between muscle fibers. Lymphosarcomatous elements predominate in this section.

2. Two fields, each 6 by 8 cm., were treated by a cross fire technic. The following technical factors were used: 250 kv., 15 ma., 1 mm. Al plus 0.5 mm. Cu, 50 cm. target-skin distance. Each field received 250 r. (air) daily, for a total dose of 2,800 r. to each field.

The patient was seen in consultation by the ear, nose and throat service on February 9. She had been under intensive roentgen therapy for nine days at that time and suffered from severe pharyngitis. The soft palate and pillars of the fauces were acutely inflamed and covered by a thin membranous deposit. There was a slight degree of trismus. The nasal cavity was essentially normal. On direct nasopharyngoscopy an irregular enlarged granular mass was

seen in the vault of the pharynx, extending like an apron of tissue across it to occupy both fossae of Rosenmüller. A biopsy specimen was obtained with an adenotome, but according to the pathological report this section showed only adenoid tissue.

This patient was discharged from the hospital on March 6 with the clinical diagnosis of nasopharyngeal lymphoepithelioma with cervical metastases before we were given an opportunity to repeat the biopsy.

Roentgen therapy was continued until March 17, when the course was completed. The general condition was good except for the severe pharyngitis (x-ray induced).

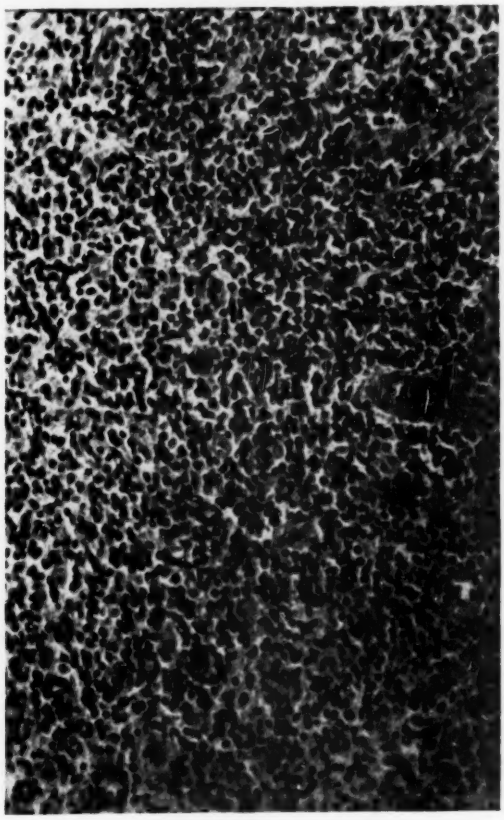

Fig. 6 (Case 4)—Photomicrograph of lymphoepithelioma (× 160) showing dense lymphocytic infiltration with scattered groups of ill-formed poorly staining epithelial cells.

The patient failed to return to the ear, nose, and throat clinic for repeat biopsy of the nasopharynx, and, despite all our efforts, she did not return for a follow-up.

Case 4.—C. A., a Negro man, aged 31, first appeared in the ear, nose and throat clinic on Dec. 14, 1950, with the following complaints: continued bilateral nasal discharge and obstruction, recurrent epistaxis, stuffiness of the ears, impaired hearing, headache, and earache on the right side. There was a constant thick copious gelatinous discharge from both nostrils, which became bloody on any attempt to clean the nose. The speech was nasal. Both drum membranes were moderately retracted, opaque, lusterless, and slightly injected. Hearing was

diminished, and tests showed an obstructive type of hearing loss in both ears. An audiogram taken later, on Jan. 28, 1951, is shown hereunder. After patient cleansing of the nose, a grayish white mass was seen far back at the posterior nares on both sides. On posterior rhinoscopy, the same growth appeared bulging back into the nasopharynx and completely blocking from view both Eustachian orifices. A biopsy specimen was taken with a biting forceps through the left nasal cavity. The pathologist made a diagnosis of the presence of innumerable acute inflammatory cells and malignant lymphocytoma.

Roentgenograms of the skull and paranasal sinuses showed no obvious bone destruction, but all the sinuses were clouded, being worse on the left side. This was due more to retained secretion than to neoplastic invasion, except for the left antrum, which showed the slightly increased homogenous density typical of carcinoma of the sinuses. Other physical and laboratory findings were not significant.

An attempt to irrigate the left antrum and instill iodized oil (lipiodol,® 40% iodine) was entirely unsuccessful. The trocar did not break through the usual bone of the antral wall in the inferior meatus but gave the feeling of entering a firm mass. The attempt to irrigate resulted in severe pain and resistance to the flow, and so the idea was abandoned. The patient was hospitalized and referred to the radiation therapy service.

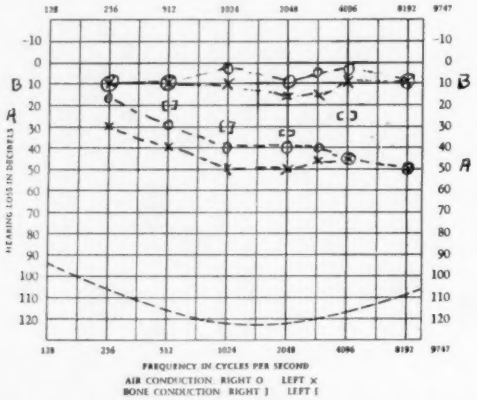

Fig. 7 (Case 4)—Audiogram A, with interrupted lines, was taken on Feb. 1, 1951. Tracing with solid lines, taken after six weeks of radiation therapy, shows marked improvement. Hearing by bone conduction was about the same on both occasions. The zero line indicates the level of average normal hearing for the ages 18 to 23.

On February 2 a Caldwell-Luc operation was done on the left antrum. The mass was found filling the sinus and in continuity through the nasoantral wall with the growth in the posterior part of the nose. The antrum and left nasal cavity as far as, but not including, the nasopharyngeal area were cleaned out. Radium needles were inserted into the sinus and a three-needle pack was placed transversely in contact with the nasopharyngeal growth and anchored through both sides of the nasal cavity. The pathological report on the specimen removed at operation was lymphoepithelioma. The patient is continuing under roentgen therapy.

COMMENT

This growth was quite bulky and apparently arose from the lymphoepithelium of the nasopharynx, extended forward to invade the antrum on the left, while posteriorly it reached the right side to occlude the choanae completely. At the present time the growth appears to be completely resolved from the choanae, no evidence being seen on posterior rhinoscopy. Audiograms taken before the start of treatment

and after one month of radiation therapy illustrate the loss of hearing that may be caused by these growths, and also the dramatic return of hearing after resolution of the nasopharyngeal neoplasm.

LYMPHOEPITHELIOMA OF THE NASOPHARYNX

Lymphoepithelioma is an uncommon primary malignant neoplasm, usually occurring in the pharyngeal region associated with Waldeyer's ring of lymphoid tissue, is composed of large immature anaplastic epithelial cells which are intimately associated with lymphoid cells, tends to metastasize early and rapidly, and is highly malignant and extremely radiosensitive.[1]

The literature on this type of neoplasm has become considerable since Jolly [2] designated the tissues of the pharyngeal tonsil as lymphoepithelial and Regaud [3] and Schminke,[4] working separately, described the characteristics of the tumor in 1921. Among those writing about this comparatively infrequent tumor and discussing its difficult clinical diagnosis, particularly its difficult pathological differentiation, are Ewing, Cappell, Martin, Crowe and Baylor, Quick and Cutler, New, and Eggston.[5]

Etiology and Incidence.—The cause of lymphoepithelioma, like cancer elsewhere, is unknown. No attempt will be made to discuss or theorize about this issue. This type of neoplasm occurs anywhere in Waldeyer's ring of lymphoid tissue, the chief locations being the posterior nares, orifices of the Eustachian tubes, vault of the pharynx, and tonsillar areas,[6] where there is an intimate association between lymphoid tissue and epithelial cells. To quote Martin and Blady,[5c]

> In our experience, in no other part of the upper respiratory and alimentary tracts is cancer so apt to be overgrown by hypertrophied lymphoid tissue.

Cloward [7] agrees:

> The mucous membrane [of the nasopharynx, etc.] is often interlaced with lymphoid tissue which has been given the name "lymphoepithelium." Tumors held by some as arising from this type of epithelium present peculiar clinical and histologic characteristics. They are frequently anaplastic and are more related to squamous than to basal cell carcinoma.

Most writers say that the tumor occurs among males predominantly. Lynch [8] says there is a proportion of 9 males to 1 female. Ewing [6] cites an incidence of

1. Burman, H. J., and Burman, D.: Schminke Tumor; Lymphoepithelioma of the Nasopharynx, Arch. Otolaryng. **37**:835 (June) 1943.

2. Jolly, C.: Assoc. Anat. **13**:164, 1911.

3. Regaud, C. R., and Reverchon, L.: Rev. laryng. **42**:369 (April) 1921.

4. Schminke, A.: Beitr. path. Anat. **68**:161 (Feb.) 1921.

5. (*a*) Ewing, J.: Am. J. Path. **5**:99 (March) 1929. (*b*) Cappell, D. F.: J. Laryng. & Otol. **53**:558 (Sept.) 1938. (*c*) Martin, H. E., and Blady, J. V.: Cancer of the Nasopharynx, Arch. Otolaryng. **32**:692 (Oct.) 1940. (*d*) Crowe, S. J., and Baylor, J. W.: Benign and Malignant Growths of the Nasopharynx and Pharynx and Their Treatment with Radium, Arch. Surg. **6**:429 (March) 1923. (*e*) Quick, D., and Cutler, M.: Surg., Gynec., and Obst. **45**:320 (Sept.) 1927. (*f*) New, G. B.; Kirch, W., and Erich, J. B.: Tumors of the Nose and Throat: Summaries of the Bibliographical Material Available in the Field of Otolaryngology, Arch. Otolaryng. **30**:283 (Aug.) 1939. (*g*) Eggston, A. A.: New York J. Med. **43**:2403 (Dec. 15) 1943.

6. Ewing, J.: Neoplastic Diseases: A Treatise on Tumors, ed. 4, Philadelphia, W. B. Saunders Company, 1940, p. 785.

7. Cloward, R. E.: Nasopharyngeal Cancer, Arch. Otolaryng. **32**:512 (Sept.) 1940.

8. Lynch, M. G.: New Orleans M. & S. J. **101**:165 (Oct.) 1948.

80% in males. However, cases reported in recent years do not support this masculine preponderance. Fox,[9] in reporting 12 cases of nasopharyngeal cancer, found a proportion of 2 females to 1 male and remarked, "The more recent publications do not show as great a preponderance of males as formerly reported." In our own four most recent cases, three patients were female, aged 32, 19, and 22, and one was male, 31 yr. old.

The tumor occurs at all ages, usually between 30 and 60, and frequently in children and Chinese.[6] The very similar transitional cell carcinoma has been reported in a 4-yr.-old child [5c] and in a 14-yr.-old boy.[10] Portman and Rétrouvey [11] reported only 32 nasopharyngeal tumors in 70,000 cases. McPhee and LaCroix of the Vancouver General Hospital [12] reported an incidence of tumors of the nasopharynx of 2.5% in 1,214 cases of all malignant neoplasms, but Godtfredsen,[13] in his statistical study, found that nasopharyngeal cancers constitute 0.3 to 0.4% of all cases. According to Lynch,[8] carcinoma of the nasopharynx constitutes 2% of all malignant tumors of the head and neck.

Ewing [14] found, among 100 cases of nasopharyngeal tumors, 30 cases of squamous-cell epithelioma, 37 of transitional-cell carcinoma, and 11 of lymphoepithelioma. Cappell [5b] found, among 121 cases, 78 cases of squamous-cell epithelioma and 12 cases of lymphoepithelioma. Martin [5c] with 87 cases, quotes 42 as transitional and 14 as lymphoepitheliomas. New and Stevenson [15] have said:

> Most of the malignant tumors of the nasopharynx are epitheliomas, and usually high grade squamous cell epitheliomas grade 4 (Broder's method), which, fortunately, are radiosensitive.

In their classification of types of malignant tumors of the nasopharynx which they found in their 271 total cases, 184 were declared squamous cell carcinomas, with 148 of these as grade 4, or undifferentiated, carcinomas. This means that over 50% were anaplastic. Since there was no attempt to separate these tumors, it seems obvious that transitional cell carcinomas and lymphoepitheliomas were included in this group.

It is seen that the incidence of lymphoepithelioma varies fairly widely for each writer. In this respect, Eggston [16] says

> the transitional cell tumors and the lympho-epitheliomas of the upper respiratory tract are so poorly differentiated that many of these types of tumors and others are grouped under sarcomas and carcinomas rendering comparative morbidity unreliable.

Pathology.—Lymphoepithelioma is regarded as the most characteristic malignant tumor of the nasopharynx. The chief locations are the posterior part of the

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9. Fox, C. C.: Carcinoma of the Nasopharynx, Arch. Otolaryng. **48**:390 (Oct.) 1948.

10. (*a*) Whiteleather, J. E.: Am. J. Roentgenol. **54**:357 (Oct.) 1945. (*b*) Prohovnik, J.: Eye, Ear, Nose & Throat Month. **24**:187 (April) 1945.

11. Portman, G., and Rétrouvey, H.: Le cancer du nez, des fosses nasales, des cavités accessoires et du nasopharynx, Paris, Gaston Doin & Cie., 1927, p. 773.

12. McPhee, J. G., and LaCroix, W. R.: Canad. M. A. J. **54**:573 (June) 1946.

13. Godtfredsen, E.: Acta path. et microbiol. scandinav. (supp. 55) 1944, reviewed by Wycis, H.: Quart. Rev. Otolaryng. & Bronchoesophag. **5**:150 (June) 1946.

14. Ewing,[6] pp. 918-922.

15. New, G. B., and Stevenson, W.: End Results of Treatment of Malignant Lesions of the Nasopharynx, Arch. Otolaryng. **38**:205 (Sept.) 1943.

16. Eggston, A. A., and Wolff, D.: Histopathology of the Ear, Nose and Throat, Baltimore, Williams & Wilkins Company, 1947, pp. 793-796.

orifice of the Eustachian tube, the vault of the pharynx, and the tonsillar areas.[6] In a series of 150 cases, Simmons and Ariel [17] found the commonest site of the disease to be Rosenmüller's fossa.

The primary growth is usually small, flat, or polypoid, obscure and silent, spreading by direct local extension, by lymphatics, and by way of the thoracic duct into the blood stream. Usually before the growth by direct extension becomes so great as to cause any obtrusive symptoms, lymphatic metastases occur in the deep cervical lymphatic chain. Distant metastases, on the whole, occur late, and pulmonary and hepatic involvement in prolonged cases may occur even without lymph node invasion.

It is the varied and, indeed, bizarre microscopic appearances which make this growth so remarkable. The description cannot be made without modification of some sort. Pathologists [18] very frequently describe lymphoepithelioma and transitional-cell carcinoma under the same heading, and, indeed, as one and the same tumor. Eggston and Wolff [16] say that transitional-cell tumors or lymphoepitheliomas have received thorough consideration by Regaud, Schminke, Cappell, Ewing, and others. However, these writers,[19] after citing the confusion that exists concerning the histologic nature of this neoplasm, maintain that transitional-cell tumors are an entirely different type of tumor and should be discussed separately. Ewing [14] and Cappell [5b] are in hearty agreement.

It seems necessary to review the salient features of these tumors in order to emphasize the difficulty of differentiation from each other and also from squamous epithelioma, on the one hand, and lymphosarcoma, on the other. We follow the outlines of the excellent and lucid description given by Cappell.[5b] He says that transitional-cell carcinoma naturally falls into a subgroup of lymphoepithelioma and describes the latter with three broad subgroups, consisting of Regaud, Schminke, and transitional-cell types.

The lymphoepithelioma of frankly carcinomatous type was described by Regaud [8] in 1921 and by Jovin [20] in 1926. The tumor cells occurring in these neoplasms are large and round, with large vesicular pale-staining nuclei, poor in chromatin, and with one or two nucleoli. The protoplasm of these cells is of indistinct outline, making the cells seem to coalesce and form a syncytium. No intercellular bridges or fibrils are demonstrable. Frequently the cells appear as broad sheets lying in a well-formed stroma; sometimes they appear as cords, thin strands, columns, or so-called windrows, giving an alveolar type of arrangement. Scattered throughout are lymphocytes, sometimes occurring in groups.

The above description is typical of lymphoepithelioma. It is true that there is a recent tendency among otolaryngologists to refer to all these types of lymphoepitheliomas of the nasopharynx as Schminke tumors. The fact remains that the growth as described by Schminke [4] in 1921 is much more difficult to differentiate with certainty. The growth is less specific and the structure more diffuse. In this

17. Simmons, W. W., and Ariel, I. M.: Surg., Gynec. & Obst. **88**:763 (June) 1949.

18. Eggston,[5g] Ewing,[6] Eggston and Wolff.[16]

19. Eggston and Wolff,[16] pp. 986-990.

20. Jovin, J.: Ann. mal. de l'oreille, du larynx **45**:729, 1926.

type the atypical epithelial cells conform to the description given by Regaud, but the elements in some parts consist of irregular, anastomosing trabeculae; in other parts, the appearance of the epithelial columns is lost and the cells become dissociated from one another, giving rise to a loosely packed mass of cells.[5b] In some parts the epithelial cells form the bulk of the tumor, while in others they are separated by a dense lymphocytic infiltration which overshadows the epithelial elements and renders recognition of the individual cells difficult, making differentiation from lymphosarcoma almost impossible. Where the epithelial cells are in preponderance, however, silver impregnation reveals a sharply alveolar architecture (Salinger and Pearlman [21]). Silver staining will also show the lack of argentophil reticular network which is typical of lymphosarcoma. In general, lymphoepithelioma of both Regaud and Schminke types is not highly vascular, necrosis and ulceration are not in evidence, and the growth is slower.

The transitional-cell carcinoma, called basal-cell carcinoma (Ribbert and Krompecher [22]), is distinguished from the other two types of lymphoepithelioma by "its tendency to form broad alveoli in which central necrosis and degeneration are more common." The broad alveolar formation shows the origin from surface epithelium more than in the other types and necessitates its distinction from anaplastic squamous cancer. There is no trace of keratinization or intercellular bridges (prickle cells). There is an absence of the intimate admixture of lymphocytes throughout the epithelial alveoli. Clinically, the chief features are ulceration and bleeding, lymphatic metastasis occurring later in this group. Cappell [5b] says that many cases present intermediate characters, rendering it difficult to fit them exactly into one or other group. He admits, "In my experience, the differences are often much less clear cut, and I cannot make an absolute distinction between lymphoepithelioma and transitional celled or Schneiderian carcinoma." Persky [23] concurs: "The similarity is so great histologically that a differential diagnosis is often difficult—so much so that many times a discordance of opinion appears when the same specimens are presented to different pathologists."

It is the anaplastic forms of epidermoid carcinoma on the one side and the large cell lymphosarcoma on the other side of the broad malignant spectrum which cause such difficulty in histological differentiation. It seems advisable to append the important differentiating features of these five types of tumors in a table without necessarily describing in detail the typical nasopharyngeal epidermoid carcinoma or the lymphosarcoma.

In spite of these seemingly accurate differentiating features, it must be said that it remains a difficult decision to distinguish lymphoepithelioma from lymphosarcoma and from transitional-cell carcinoma and epidermoid carcinoma.[24]

Referring to these lymphoepitheliomas, Eggston and Wolff [19] say:

> The stroma of these tumors is very delicate. They are extremely cellular and it is only by special reticulum stain that any such fibrils are at times demonstrable.

21. Salinger and Pearlman, cited by Eggston and Wolff.[19]

22. Ribbert and Krompecher, cited by Ewing.[14]

23. Persky, A. H.: Lymphoepithelioma of the Nasopharynx: Report of a Case, Arch. Otolaryng. **37**:813 (June) 1943.

24. Crowe and Baylor.[5d] Ewing.[14]

Summary of Important Differentiating Features of Five Types of Tumor

Epidermoid Carcinoma	Lymphoepithelioma			Lymphosarcoma
	Transitional-Cell *	Regaud *	Schminke *	
Cells in broad alveolar formation with mosaic cell structure	Broad alveolar formation	Cells in sheets and columns, tends to form syncytium embedded in stroma rich in lymphocytes	Cells diffuse; may be scattered or may be overshadowed by the variable and sometimes dense lymphocytic infiltration	No alveolar formation; diffuse mass of large round cells with a typical nuclei
Epithelial cells in great preponderance	Less intimate association between lymphocytes and malignant cells			Numerous nucleoli and mitoses; epithelial cells very few, irregular, and ill-defined
Tendency to keratinization and formation of prickle cells; Perles are not typical but form stratified balls	Cells delicate without spines; no prickle cells; no keratinization; no perles	None	None	None
Intercellular bridges but no argentophil reticular fibrillas	No intercellular bridges; no argentophil reticular fibrillae	None	None	None
		None	None	Reticular argentophil intercellular finely meshed fibrillae, part of stroma; rapid bulky growth
Local growth not rapid	Local growth rapid	Slow growth	Slow growth	.....
Necrosis and central degeneration not common	Necrosis and ulceration common	Not common	Not common	Necrosis and central degeneration common

* These three types are clinically and therapeutically indistinguishable.

It would seem logical, and to be following a more direct road to a clear-cut and understandable differentiation of these tumors, for us to follow the dictum of Ringertz,[25] who

> considers the chief histologic differentiation between lympho-epithelioma and reticulo-cytoma is that the first mentioned does not form an argentophilic fibrillar network, or at least a network that shows up finely meshed when stained with silver, while those forms of reticulocytomas which resemble lympho-epithelioma always form a finely meshed network.

We find that the mention of intercellular bridges and fibrillae as distinctive of squamous epithelial growths on the one hand and argentophil intercellular fibrillae as specific for lymphosarcomas on the other is a source of confusion and requires some elucidation. In describing the connection between cells in an epithelial sheet, Maximow and Bloom [26] say that epithelial cells are kept together by "small protoplasmic processes which run from one cell body to another forming intercellular bridges." The tonofibrils of the cell cytoplasm run through the intercellular bridges and sometimes through several cells. After the action of silver nitrate, especially in simple squamous epithelium, the cell limits are outlined by black contours. The intercellular fibrils are really part of the epithelial cell structure and will be seen in differentiated epithelial neoplasia. The intercellular bridges produce the appearance of the so-called prickle cells. These will be seen in typical squamous epitheliomas but will be missing in the anaplastic tumors. The argyrophil fibers of reticular tissue "are systems of nonelastic connective tissue fibers which form networks" as a "reticular framework of the lymphatic and myeloid tissues."[27] They are called precollagenous fibers and are usually found in those places in the connective tissue where undifferentiated cells of mesenchymal nature are assembled. They are electively impregnated with silver by modified Bielschowsky methods. Their presence, therefore, in reticulum cell lymphocytic sarcoma is diagnostic and differentiates this tumor from lymphoepithelioma.

To illustrate the present status in the histologic differentiation of these tumors, two quotations speak for themselves:

> The separation of true lympho-epithelioma from anaplastic forms of epidermoid carcinoma, transitional cell carcinoma, lympho-sarcoma and the like is often difficult and at times must remain an arbitrary decision. (Ewing.[14])

> Additional differentiation of these complicated malignant tumors of the nose and throat is highly desirable, and as they are more carefully classified, we hope a clearer interpretation of the cell types will follow. (Eggston and Wolff.[16])

There is an obvious mounting desire and effort to separate and identify these anaplastic malignant tumors.

Diagnosis.—Late diagnosis of this neoplasm is almost always the rule because the primary tumor is small, silent, slow-growing, and hidden in the nasopharynx. The symptoms are usually vague and wanting until metastases occur in the deep cervical nodes and the progressive enlargement of a node eventually brings the patient under medical care.

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25. Ringertz, cited by Eggston and Wolff.[19]

26. Maximow, A. A., and Bloom, W.: Textbook of Histology, ed. 4, Philadelphia, W. B. Saunders Company, 1942, p. 35 and p. 338.

27. Maximow and Bloom,[26] p. 71.

Cervical adenitis is most frequently the earliest symptom, in 42% of cases according to New.[28a] Other writers [6] say that it is the earliest sign in 50% of cases. Simmons and Ariel [17] found early cervical metastases in 83.3% of their cases; Godtfredsen [13] puts the incidence at an average of 70%, while Fox [9] found such early cervical metastases in 80% of cases. Lymphadenopathy is at first unilateral and later becomes bilateral. It usually starts just posterior to the angle of the jaw and extends to other nodes, which later coalesce to form a large mass and involve both anterior and posterior triangles. Extension to lungs, liver, and bone may be early but it usually occurs late.

Other early symptoms depend on the site and the degree of extension of the primary tumor. If it is at the orifice of the Eustachian tube or in Rosenmüller's fossa, signs of Eustachian obstruction and its sequelae appear early; so deafness, earache, or fluid in the middle ear appears as a first symptom in about 33% of cases.[9] Vague sensations of stuffiness in the nasopharynx and postnasal secretion are noted by the patient. Bleeding with epistaxis or hemoptysis is not infrequent—in 25% of cases.[9] Loss of weight and weakness are not always early signs. Headache and pain along the distribution of the trigeminal nerve and disturbance of swallowing due to invasion of the soft palate or later involvement of the ninth nerve all increase in severity with the growth of the tumor. The above signs are the commonest [28a,b] and warrant a thorough examination of the nasopharynx.

Other signs appear late and are due to involvement of the cranial nerves by encroachment of the mass on the base of the skull, destroying bone and invading the cranial cavity through the foramens. However, Godtfredsen [13] found early ophthalmoneurologic symptoms in 33.5% of his series of 454 cases. According to Burman,[1] the first nerve to be involved is the sixth. The others most frequently encroached upon are the fifth, third, fourth, and second, and later the ninth, tenth, eleventh, and twelfth. So the neurologic symptoms (e. g., diplopia, pain, trigeminal neuralgia, ptosis, dysphagia, and hoarseness) are determined by the nerves involved. Intraorbital extension occurs by way of the foramen lacerum, carotid groove, and superior orbital fissure. Hence, there are optic atrophy, exophthalmos, etc. Simmons and Ariel [17] found in their series of cases 36.6% with symptoms of involvement of the cranial nerves. Here may be noted a case of transitional-cell carcinoma with generalized spread and involvement of all 12 cranial nerves reported by Flynn.[28c]

In the fully developed pathologic picture, Godtfredsen [13] found the average frequency of the groups of symptoms in his large series to be as follows: metastatic cervical lymph nodes, 70%; otologic symptoms, 49%; nasopharyngeal symptoms, 40%, and ophthalmoneurologic symptoms, 38.8%.

The actual primary tumor in the nasopharynx appears as a small mulberry-like growth, the size of an olive, of irregular outline, and giving the appearance of a soft spongy granular elevation. It may spread to the Eustachian tube or by an apron of tissue across the vault to the other side. Discovery of this malignant tumor requires a complete examination at all times, since almost any otolaryngologic

28. (*a*) New, G. B.: Tr. Am. Acad. Ophth. **36**:39, 1931. (*b*) Martin, C. L.: Ann. Otol. Rhin. & Laryng. **52**:146 (March) 1943. (*c*) Flynn, J. E.: J. Iowa M. Soc. **36**:9 (Jan.) 1946.

symptom may present itself. Such an examination includes a thorough inspection of the nasopharynx by posterior rhinoscopy and nasopharyngoscopy. A search for metastases, local and distant, must be made and should include biopsy of any suspected node.

It is unfortunate that the earliest symptom may be cervical metastasis, since this may occur one year or more from the start of the initial vague signs of the primary tumor.[13] After successful biopsy of a metastasis, discovery of the primary growth requires an urgent, thorough search and immediate and repeated biopsies until it is found. An application or two of roentgen therapy could so decrease the growth that successful biopsy is difficult.[9] Radiation causes acute cell death of these highly sensitive undifferentiated tumor elements. Secondary replacement fibrosis is the most marked change in the stroma and is in proportion to the radiation.[29] The histological report of a benign process taken from the margins of a malignant tumor may obscure the diagnosis. A specimen from deep in the tissue is necessary. It is only too true that one or more years may elapse between the appearance of the cervical metastasis and the discovery of the primary tumor.[6]

X-rays are not of great help in the early discovery of a malignant nasopharyngeal tumor. Films must be taken at several angles to show a fairly large soft tissue mass without bone invasion. When bony destruction and widening of the basal foramens have occurred without previous diagnosis, general metastasis is already widespread. Roentgenograms give evidence in 50% of advanced cases.[9] They are, of course, helpful in detecting malignant deposits in bone and body cavities. A classic triad is mentioned "as almost pathognomonic," roentgenologically, of a nasopharyngeal cancer by Baylen, Reeves, and Kernan.[30] These three signs are enlargement of the sphenoidal foramens, erosion of the basiocciput, and destruction of the petrous tip. These writers say that in 23 out of 32 proved cases this triad was shown. It is obvious, however, that only advanced cases would show these x-ray signs.

Positive and specific diagnosis can depend only on biopsy, and this would come about more frequently if the nasopharynx were thoroughly inspected in all otorhinolaryngological examinations, and certainly in all cases of sudden appearance of nodes in the neck, especially if unilateral, and in all cases of epistaxis of undetermined origin. Biopsy should be made of any questionable nasopharyngeal mass. This is done most simply with a La Force adenotome,[1] and bleeding is practically never troublesome.

Prognosis.—A characteristic of the lymphoepithelioma is the high degree of radiosensitivity. Unfortunately, however, discovery of the tumor is almost always late and the radiosensitivity does not necessarily insure a favorable termination, most patients succumbing to metastases to bone, liver, and lungs.[6] On the other hand, we have gone a long way from Furstenberg's conclusions in citing 40 cases of cancer, to wit: "Treatment is exceedingly futile and the prognosis hopelessly discouraging."[31]

29. Hall, J. W., and Freedman, M.: Radiology **50**:318 (March) 1948.

30. Baylen, G. M.; Reeves, R., and Kernan, H.: South. M. J. **42**:467 (June) 1946.

31. Furstenberg, A. C.: Surg., Gynec. & Obst. **66**:400 (Feb.) 1938.

Martin,[32] of Memorial Hospital, had a five year cure rate of 42%. The Mayo Clinic, in 1940, reported a five year survival rate of 29.3% and 18.2% 10 year cures. Godtfredsen,[13] in the analysis of his own cases, observed that 22.2% of his patients were symptom-free for five years. Concerning local extension and near metastases, he showed that despite x-ray proof of destruction of the base of the skull and despite metastatic cervical nodes and ophthalmoneurologic symptoms, patients with intensive radiation therapy may be made permanently free of symptoms. With invasion of the base of the skull, results may be very dramatic. Referring to one such case with x-ray evidence of destruction of the sella and clinoid processes, New and Stevenson[15] said, "After treatment, regeneration of the bone occurred in a remarkable fashion."

The interval from the appearance of the first symptom until the exact diagnosis is made varies from one to six years, and approximately one-fourth to one-third of the patients are given wrong diagnoses and wrong treatment.[13] The following figures, quoted from Simmons and Ariel[17] in their series of 150 unselected cases, emphasize this point: It was found that patients waited an average of 3.2 mo. before consulting a physician; an average of 6.9 mo. elapsed before the physician made a correct diagnosis; a period of 10.1 mo. passed before adequate therapy was instituted. Among the 128 patients who died, an average time interval of 27 mo. occurred from the onset of signs until death. With adequate treatment, the interval averaged 31 mo. until death; without adequate treatment the life expectancy was 17 mo. Early diagnosis and early treatment are to be emphasized.

Treatment.—The nasopharynx is inaccessible to radical surgery. The treatment of lymphoepithelioma here is almost exclusively by roentgen therapy. Intensive fractional roentgen therapy to the site of the primary tumor and usual bilateral routes of extension is the treatment of choice. The dosage is regulated by the extent of the disease, the patient's general condition, and the reaction to treatment. "It is agreed that the initial dosage of x-radiation should be of maximum amount."[9] The usual case, with minimal lymphadenopathy, requires about 4,000 r in air. This is given by about 12 to 15 daily doses of 150 to 250 r in air through portals on alternating sides.[22] The larger dose may be used through a wide field. At other times, the field may be split into two small portals and the smaller dosage (125 to 150 r) given to each. Ports through the antrums, the frontal area, the orbit and occiput, and the neck, especially if there is adenopathy, are used, and the series repeated according to necessity and the discretion of the roentgenologist. Other roentgenologists[33] vary the technique.

Radium may also be used, especially when cavitary exposures become necessary by reason of intranasal spread, blockage of sinal orifices, involvement of the orbit, etc. Radical antrotomy may be done and radium inserted. Others[34] mention radium by external packs for a total exposure of around 300,000 mg.-hr. A close watch must be kept on the blood count, for sometimes a leucopenia dictates at least a temporary cessation of radiation therapy. Infection, pain, anemia, and the general health of the patient must be treated appropriately.

32. Cited by Ewing.[6]

33. Whiteleader, A. J.: Radiology **24**:187 (April) 1945. Martin.[28b]

34. Delph, J. F., in discussion on Lawson, L. J.: Primary Carcinoma of the Eustachian Tube: A Study of Evidence of Its Occurrence, Arch. Otolaryng. **37**:890 (June) 1943.

COMMENT

Four cases of lymphoepithelioma of the nasopharynx have been presented, three early and one advanced.

Case 2 rendered a positive specific diagnosis of lymphoepithelioma on section of one of the metastatic cervical nodes which were the predominant early symptom. She showed a definite mass in the nasopharynx, but the only biopsy obtainable was negative for malignancy after radiation therapy.

Case 1, our principal case, presented typical and interesting features that are worthy of note. There was a minimum of three months before the patient sought treatment for her "stuffy nose," epistaxis, and weight loss. Four further months passed before diagnosis of malignant disease was made. Ten months from the beginning of symptoms and seven months since she sought medical care, the specific diagnosis of lymphoepithelioma was made. Two months later, or 12 mo. from the start of symptoms, the primary tumor was positively proved to be in the nasopharynx.

The pathological diagnosis of malignant lymphosarcoma, then epidermoid carcinoma, then malignancy of atypical epithelial cells, and the later specific diagnosis of lymphoepithelioma after review of all slides, all dramatically illustrate the difficulty in pathological differentiation of these lymphoepitheliomas. It must be admitted that these tumors sometimes change their characteristics on implantation elsewhere. It is the tumor cells which metastasize freely, while the lymphocytes do not seem to have the same facility in following the former. New, Broders, and Childrey [35] emphasize this point in their comment:

> It is not known why metastatic growths are not always of the same cell type as the primary lesion. It is indeed strange that on metastasizing, a mixed lymphoid and epithelial cell type of neoplasm should lose one of its types of cells.

Our principal case so typically illustrates the usual course of events in these tumors—the initial vague symptoms, the delay in the patient's seeking medical aid, the delay in diagnosis of malignancy, the difficulty in specific pathological differentiation—it has prompted us to present it with three other cases and to review the general picture of these lymphoepitheliomas of the nasopharynx.

SUMMARY

Four cases of lymphoepithelioma of the nasopharynx have been presented. The principal case was presented in some detail to illustrate its conformity with the typical characteristics of this tumor. A few photomicrographs have been selected from the cases to show the varied microscopic picture that these lymphoepitheliomas may present. A general review of the literature has also been offered with special emphasis on the pathology and diagnosis of these comparatively infrequent neoplasms of the nasopharynx. The necessity is emphasized for early and thorough examinations and repeated biopsies where indicated.

154 W. 119th St.

35. New, G. B.; Broders, A. C., and Childrey, J. H.: Surg., Gynec. & Obst. **54**:164 (Feb.) 1932.

OTOGENOUS INTRACRANIAL COMPLICATIONS

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THE PURPOSE of reporting these cases is primarily as a reminder that intracranial complications of chronic suppurative otitis media still play an important part in the practice of otology. Furthermore, the antibiotics and chemotherapeutic agents, although very helpful adjuncts in therapy, are not entirely curative and may give a misleading and masked picture of the actual pathologic condition. This may unnecessarily delay surgical intervention.

Lateral sinus thrombosis and thrombophlebitis are similarly affected by antibiotics and chemotherapeutic agents. Galloway,[1] as far back as 1939, stated that thrombosis of the lateral sinus probably can be dealt with successfully without chemotherapy if necessary. The chemotherapy hastens the cure and prevents local and general spread of sepsis. Cunning,[2] in discussing chemotherapy, mentions that it is of great help but that it must not take the place of surgical treatment. This impression, as well as the tendency of the antibiotics to mask the clinical picture, is a well established and universally accepted fact. It has been repeatedly emphasized in the literature by many writers, and the following two cases are illustrative.

CASE 1.—M. D., a woman aged 21, was admitted to the ear, nose, and throat ward on May 20, 1949, with a history of discharge from the left ear since childhood. Five days before admission she had pain in the ear, associated with profuse discharge. On examination she was found to be acutely ill, extremely lethargic, and uncooperative. The temperature was 100 F., pulse 92, and respiration 22. The left ear canal was filled with foul pus, and the drum membrane was absent. There were slight periosteal thickening and tenderness over the left mastoid and moderate neck rigidity. The spinal fluid was clear, the Pandy test reaction 1 +, and the cell count 200, mostly polymorphonuclear leukocytes. The pressure was 170 mm. of water, with the Queckenstedt sign normal bilaterally. The culture was sterile, serology test results were normal, glucose was 82 mg. per 100 cc. and protein 62 mg. Roentgenograms of the mastoids showed poor pneumatization of both sides with an area of rarefaction suggestive of a cholesteatoma in the periantral area and an indistinct lateral-sinus plate on the left. A diagnosis of left chronic suppurative otitis media with cholesteatoma and secondary meningeal irritation was made. Treatment consisted of administration of penicillin, 300,000 units daily, and sulfadiazine, 1 gm. every four hours.

The patient seemed to improve the first three days, with the highest temperature 100.6 F. On the fourth day the temperature rose to 101.8 F., associated with pain in the ear, increased

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1. Galloway, T. C.: Chemotherapy, Arch. Otolaryng. **30**:901 (Dec.) 1939.

2. Cunning, D. S.: Chemotherapy of Diseases of Nose and Throat, Arch. Otolaryng. **36**:609 (Oct.) 1942.

tenderness over the mastoid, and edema of the left external auditory canal. A left endaural radical mastoidectomy under endotracheal anesthesia was done on that day. A large cholesteatomatous cavity was found in the periantral area. The lateral sinus plate was intact, but upon removal about 10 cc. of pus escaped under pressure. The dura of the posterior fossa was exposed widely and appeared thickened and gray. The lateral sinus was collapsed and could not be definitely identified. Granulations were found in the tip area over the jugular bulb. The dura of the middle fossa was also exposed and found to be discolored. Needling in the region of the lateral sinus revealed no free bleeding.

The following day the patient responded poorly and the neck rigidity had increased. The findings were the spinal fluid clear, the Pandy test reaction 1+, only 20 cells, pressure 210 mm. of water, and the Queskenstedt sign normal on the right, with only a slight rise in pressure on the left. The temperature was normal, and antibiotic therapy was continued. On the third day the patient was out of bed and had an uncomplicated postoperative course until discharge June 29, four weeks after surgery. The spinal fluid a week before discharge was normal, with a positive Queckenstedt sign on both sides. She has been observed carefully during the past year and has remained perfectly well. The diagnosis was chronic left suppurative otitis media with cholesteatoma, perisinus abscess, and thrombophlebitis of the lateral sinus.

Whether or not the lateral sinus should have been opened in this case is a point for discussion. It was our belief in this case, having found an abscess and sufficient pathologic condition to account for the clinical picture, that no further surgery on the lateral sinus was necessary. In the event of additional complications, ligation of the jugular vein and/or opening of the lateral sinus could be done.

CASE 2.—W. T., a Negro man aged 33, was admitted to the ear, nose, and throat ward on October 16, complaining of generalized aches and pains and soreness of the left ear and left side of the neck. He had had recurrent drainage from the left ear for 15 mo. and chills and fever daily for two weeks.

On examination there was found to be foul pus coming from the left ear, tenderness over the mastoid bone, and marked tenderness over the left internal-jugular vein. The liver was enlarged four fingerbreadths below the right costal margin. The medical consultant diagnosed severe toxic hepatitis and suggested withholding surgery until his condition improved. Hemoglobin was 66 per cent, the red blood cell count 3.54 million, the white blood cell count 27,800, the Kahn test reaction negative, and liver-function tests indicative of moderately severe toxic hepatitis.

During the next five days the patient's condition seemed to improve, but a low-grade fever of up to 100.2 F. daily persisted. The spinal fluid on admission was clear, the Pandy test reaction negative, pressure 380 mm. of water, and blood cell count approximately 100 per cubic centimeter.

On October 23, shooting pain suddenly developed in the back of the head and the oral temperature was 102.8 F. There were no new physical findings. Spinal puncture was done, and fluid was clear, the Pandy test reaction negative, no cells were found, and the chemistry was normal. The pressure was 220 mm. of water, rising 80 mm. on compression of the right jugular vein and only 10 mm. on compression of the left jugular vein.

The following day a left endaural radical mastoidectomy was done under local anesthesia. The preoperative diagnosis was left lateral sinus thrombosis. A sclerotic mastoid was found with a small antrum filled with granulations. A large perisinus abscess containing 10 cc. of pus was found near the mastoid tip, covering the lateral sinus and dura of the posterior fossa medial to it and extending into the tip. Granulations covered the lateral sinus, and needling of the sinus revealed no free bleeding. The radical cavity was completed and the wound packed lightly. A culture of the pus yielded no growth.

Three days later the patient became afebrile and steadily improved. The spinal fluid two weeks later showed clear fluid with 15 cells per cubic centimeter. Chemistry and bacteriology were normal and pressure was 270 mm. of water with no rise on compression of the left jugular vein. Liver-function tests showed improvement. Discharge from the ear subsided, and during the last three days of hospital stay he complained of a vague headache of moderate severity, partly relieved by acetylsalicylic acid. He was discharged on November 16, 22 days after surgery.

The patient reentered Cook County Hospital on Dec. 1, 1949, with a history given by his wife of being well for more than a week after discharge. Intermittent headaches then developed. On November 29, he talked very slowly, did not eat or drink. He was incoherent the next day and was seen by a physician who advised hospitalization.

On admission the patient was comatose, with blood pressure 120/70, respiration 30, pulse 120, and temperature 104 F. Lumbar puncture showed ground-glass fluid loaded with cells, pressure 550 mm. of water, and the Pandy test reaction 4+. The reflexes were equal bilaterally, and muscular rigidity to passive movements and muscular tremors on the left side were noted.

A left postauricular incision was made, exposing the old operative site. Thick granulations were present over the lateral sinus and dura of the posterior fossa. The dura of the middle fossa was exposed and found tense. When incised, 30 to 40 cc. of pus and turbid fluid were released under pressure. The surface of the inferior temporal gyrus was necrotic, and an additional 20 cc. of pus was aspirated from the subdural space. A rubber tube was placed between the dura and the temporal lobe and a Penrose drain in the mastoid cavity. The patient did not regain consciousness and died four days later.

Postmortem findings revealed left temporal subdural abscess, diffuse purulent meningitis, and generalized cerebral edema. The left lateral sinus was filled with pus extending into the torcula, the sagittal sinus, and part of the right lateral sinus. There were focal and confluent bronchopneumonia bilaterally and hemorrhagic tracheobronchitis. An interesting finding was spontaneous rupture of the middle third of the esophagus, with gastric contents in the pleural cavity.

We feel this case was mishandled in several respects. With a history of chills and fever and severe ear pain, surgery was delayed for eight days. The presence of a toxic hepatitis was, in retrospect, probably due to the lateral sinus thrombophlebitis, which eventually resulted in thrombosis. Also the symptoms seemed to clear up on administration of sulfonamides and penicillin.

Although the pathologic picture of a perisinus abscess and collapsed lateral sinus was similar to that of the previous case, surgery on the lateral sinus was incomplete because of the positive Queckenstedt sign on that side, tenderness over the jugular vein in the neck, history of chills and fever, and a definite anemia. These findings indicated a probable suppurative thrombophlebitis and a possible thrombosis of the left lateral sinus. The sinus should have been opened.

The interesting situation regarding thrombophlebitis of the lateral sinus is that chemotherapy has not altered the controversial opinions which still exist, especially concerning ligation of the internal jugular vein. There is greater tendency at present not to ligate the jugular vein.

Blassingame [3] reported two cases of lateral sinus thrombosis showing that the spread of infection in a thrombosed vein is not always in the direction of the blood flow, casting doubt upon the expediency of ligation in lateral sinus thrombosis. Ersner and Myers [4] also state that extension from the lateral sinus is retrograde rather than downward. Harpman [5] advises restriction of jugular vein surgery mainly to drainage and, rarely, resection of the vein, when it is the seat of suppurative thrombophlebitis. It may be divided in other cases in which there is no response to simple treatment. Rosenwasser,[6] in reviewing 100 cases of lateral sinus throm-

3. Blassingame, C. D.: Lateral Sinus Thrombosis with Case Reports, Laryngoscope **52**:596 (July) 1942.

4. Ersner, M. S., and Myers, D.: Treatment of the Lateral Sinus Without Ligation of the Internal Jugular Vein, J. A. M. A. **109**:919 (Sept. 18) 1937.

5. Harpman, J. A.: Treatment of Otogenic Blood Stream Sepsis, J. Laryng. & Otol. **62**:11 (Jan.) 1948.

6. Rosenwasser, H.: Thrombophlebitis of the Lateral Sinus, Arch. Otolaryng. **41**:117 (Feb.) 1945.

bosis, suggests that if there is any doubt as to the safety of leaving the vein patent it should be ligated either at the time of operation or subsequently. In addition to the efficacy of ligating the internal jugular vein, one must remember the rare but possible serious intracranial circulatory disturbances from sudden interference with a patent lateral sinus. This may occur when heterolateral corresponding vessels are unduly small or when most of the blood in the longitudinal sinus is directed to the lateral sinus on the obstructed side. The proper handling of the thrombus is also a subject of controversy. The consensus is that the thrombus is a protective mechanism, as expressed by Kopetsky,[7] Ersner and Myers,[4] and Harpman.[5]

The proper surgical treatment of thrombosis of the lateral sinus will vary depending upon the surgeon's judgment at the time of operation. Certain procedures are well established and should be carried out. Adequate chemotherapy must be given before and after surgery to control local and general sepsis. The lateral sinus should be exposed until normal dura is found, if possible, with opening of the sinus and removal of the loose infected clot without breaking down the protective barriers fixed by the adherent thrombus. Whether or not this last procedure should be carried out extensively to obtain free bleeding from both torcular and jugular vein bulb ends is debatable. The ligation of the jugular vein should be restricted to suppurative thrombophlebitis and to those cases in which bacteremia and sepsis persist following adequate local therapy to the sinus.

CASE 3.—J. G., a man aged 41, had intermittent drainage from his right ear since the age of 12 yr. On Oct. 1, 1949, severe pain developed about the right eye and ear and he was given penicillin daily for three weeks. During this period a tympanotomy was presumably done, with no relief of the severe headache or ear pain. On October 22, he had three episodes of projectile-type vomiting and chills and fever. He was hospitalized at another hospital on October 25 and continued receiving penicillin. On October 27 he became comatose and remained in coma until November 7. During this time he received 500,000 units of penicillin and 250 mg. of aureomycin every three hours. Spinal-fluid culture on October 31 showed a pure growth of Staphylococcus aureus. On November 13 spinal fluid contained 430 white blood cells per cubic millimeter, with 69% polymorphonuclear leucocytes. Sugar was 60 mg. per 100 cc. and protein 260 mg. Smear and culture specimens yielded no pathologic growth. Neck rigidity disappeared on November 13, and the patient became afebrile on November 16. On November 18, seven weeks after the onset of his acute illness, he was transferred to the Cook County Hospital.

When first seen, the patient was confused and answered questions slowly. He was emaciated, having lost 35 lb. (15.9 kg.) since the onset of his sickness. The blood pressure was 120/70, oral temperature 101 F. The right ear canal was filled with pus and the middle ear full of granulation tissue. The deep reflexes were normal, and there was no evidence of aphasia.

Roentgenograms of the mastoids on November 18 showed a bony defect in the right temporal bone in the antrum area suggestive of cholesteatoma. The spinal fluid was bloody, and the culture was sterile. The temperature was normal after admission. Treatment consisted of 300,000 units of penicillin daily, 0.5 gm. of streptomycin every six hours, and 250 mg. of aureomycin every three hours. Culture specimens of the ear taken on admission grew Pseudomonas aeruginosa, Proteus morganii, and nonhemolytic Staphylococcus aureus.

On November 21, a right endaural mastoidectomy was performed under local anesthesia. The preoperative diagnosis was cholesteatoma and probable brain abscess. At operation the antrum was found filled with pus and granulation tissue. The bony labyrinth was covered with granulations, and the bone over the posterior semicircular canal appeared carious. There was a 1 cm. defect of the tegmen over the antrum. The dura of the middle fossa was soft and necrotic in this area and was entered easily, releasing 1 oz. (2.8 gm.) of thick pus. Necrotic dura and brain tissue

7. Kopetsky, S. J.: Acute and Chronic Otitis Media and Sinus Thrombosis, Arch. Otolaryng. **16**:575 (Oct.) 1932.

were removed with a sharp curette, uncapping the abscess cavity. Suction was used to evacuate the depths of the abscess. A rubber drain was inserted into the abscess cavity and the operation terminated. Cultures of this pus gave a pure growth of Proteus vulgaris.

Improvement following surgery was steady and dramatic. The ear wound was irrigated daily with penicillin and streptomycin solution. Administration of the antibiotics was discontinued completely on December 21. On December 20 the spinal fluid was clear with a yellowish hue. The pressure was 30 mm. of water with a normal rise on jugular vein pressure bilaterally. The culture was sterile.

The patient was discharged on Jan. 3, 1950, after 47 days in the hospital. There were no apparent neurological or mental residua. Diagnosis was chronic otitis media with cholesteatoma and right-temporal lobe abscess.

The preceding case is a classic example of an attempt to control and cure an otogenous intracranial complication by antibiotics alone. The patient received large doses of penicillin and aureomycin over a period of seven weeks and four weeks, respectively. There was no evidence at operation that this had done anything to clear the focus of infection in the mastoid bone or to prevent the spread of infection into the brain. The antibiotics used did, however, preserve the patient's life and seemed to bring about recovery from coma, masking the presence of a brain abscess. The abscess was treated by complete evacuation of the pus and removal of superficial necrotic tissue with subsequent irrigations with penicillin.

The surgical approach to a brain abscess is conditioned by the training and experience of the operator. Those familiar with neurosurgical methods may reach the abscess through an uninfected field. Most otologists prefer to operate through the mastoid bone for the following reasons. First, the mastoid bone must be thoroughly explored and all diseased structures removed to prevent a recurrence of intracranial complications. Second, the route of extension of the infection into the brain may be found, thus facilitating location and removal of the abscess, particularly in the temporal lobe.

The time of surgical intervention is of utmost importance. Sachs,[8] speaking from 30 years' experience with brain abscesses, believes "no unencapsulated abscess should be drained." He also found that "during the acute stage, penicillin is an invaluable aid in bringing about encapsulation."

The treatment of the encapsulated brain abscess is a subject of much controversy. Recent reports by Fincher,[9] Sachs,[8] Tinsley,[10] and others of cerebral and cerebellar abscesses removed *in toto* are very promising. The cases reported have shown that the procedure is well tolerated and the mortality remarkably low. In many of these cases there was no tract from the original focus, and thus complete removal was feasible without danger of postoperative herniation of brain tissue through a defect in the dura.

Dandy [11] stated that single abscesses due to Staphylococcus and Streptococcus organisms may be cured with one aspiration. Sachs [8] advocated excision in toto,

8. Sachs, E.: Analysis of Brain Abscesses Observed During the Past 30 Years, Ann. Surg. **123**:785 (May) 1946.

9. Fincher, E. F.: Craniotomy and Total Dissection as a Method in Treatment of Abscess of the Brain, Ann. Surg. **123**:789 (May) 1946.

10. Tinsley, M. J.: Radical Extirpation of Acute Brain Abscesses, Illinois M. J. **92**:102 (Aug.) 1947.

11. Dandy, W. E., in discussion on Sachs.[8]

using aspiration only as a palliative procedure until more radical treatment can be instituted. If, in the course of excision, rupture occurs, marsupialization may be resorted to. Harpman [12] advocates complete removal of all the pus and necrotic tissue. Since this cannot be done by aspiration alone, the abscess cavity is laid open and its contents evacuated by suction.

Usually otogenic abscesses are mixed infections. In those cases in which the bacteria are very sensitive to sulfonamides and the antibiotics, even the simplest treatment, such as a single aspiration, may suffice. Most abscesses due to chronic ear infection contain resistant organisms, such as Pseudomonas, Proteus, Escherichia coli, and others. These infections require a more radical surgical procedure to effect a cure.

The fundamental principles of treatment in the case of brain abscess are first, localization and control of the infection with the aid of time, sulfonamides, and the use of the antibiotics; second, the thorough and complete surgical removal of the source of infection in the mastoid bone; and third, the direct surgical attack on the abscess, which varies from a single aspiration to removal *in toto,* depending on the pathological circumstances.

The fourth case is an instance of meningitis from chronic ear suppuration.

CASE 4.—V. M., a man aged 53, was admitted to the ear, nose, and throat ward on Nov. 4, 1949, with a history of intermittent discharge from the right ear since childhood. There had been two acute episodes of pain and increased discharge from the ear, one two years before and another three weeks before admission. The present episode began a week before admission with headache, chills and fever, discharge, and stiff neck. For three days before admission he had received 300,000 units of penicillin daily.

On examination the patient was found to be stuporous and unable to cooperate. There was a marginal, posterior-superior perforation of the right ear drum membrane, with pulsating, purulent discharge. There was slight mastoid tenderness and marked neck rigidity. The temperature was 103 F., pulse 72, respiration 24. Spinal puncture revealed turbid gray fluid loaded with white blood cells. Pressure was 260 mm. of water with normal Queckenstedt sign bilaterally, sugar 19 mg. per 100 cc. and protein 134 mg. Culture of the spinal fluid showed anaerobic gram-positive rods resembling diphtheroids. Roentgenograms showed cloudiness of the right mastoid with loss of detail.

The patient was given penicillin and fluids intravenously and a right postauricular mastoidectomy was done under local anesthesia on the day of admission. A hard sclerotic mastoid bone was encountered. There was a cavity extending from the antrum to the tip, filled with granulations. A large tip cell had eroded the sinus plate, and granulations covered the area of the jugular bulb. The dura of the posterior fossa was uncovered and 2 cc. of pus found in Trautmann's triangle over the posterior fossa. The dura was exposed to the sinodural angle and in the middle fossa. The subdural spaces of both fossae were needled to rule out the possibility of subdural abscess, and turbid cerebrospinal fluid was recovered. The lateral sinus was needled and free blood obtained. Because of the patient's precarious condition, the radical operation was not completed.

Postoperatively he received penicillin, streptomycin, sulfadiazine, and fluids intravenously. Six hours after operation, the patient responded and improvement was steady. The spinal fluid three days postoperatively showed a xanthochromic, slightly turbid fluid with 300 cells per cubic millimeter, Pandy test reaction 2+, and a pressure of 170 mm. of water with a normal Queckenstedt sign. A culture grew Proteus vulgaris. One month later the spinal-fluid cell count was 24 white blood cells per cubic millimeter, sugar 62 mg. per 100 cc. and protein 100 mg.

12. Harpman, J. A.: On the Treatment of Otogenic Brain Abscess, J. Laryng. & Otol. **64**:319 (June) 1950.

Because of persistent oral temperature of up to 99.8 F. and failure of the spinal fluid to return entirely to normal, the mastoid was reexplored on December 12, five weeks after the first operation. The dura was inspected and the radical cavity completed. No pus or retained infection was encountered.

Four days after operation the spinal fluid cell count was 13 per 100 cc., with normal chemistry. Ten days after the second operation the fluid was entirely normal. On December 28 the patient was discharged as recovered and has been seen frequently in the clinic and remained well.

The diagnosis was chronic otitis media, extradural abscess of the posterior fossa, and purulent meningitis.

The preceding case was an instance of meningitis secondary to chronic suppurative otitis media, which was becoming progressively worse with penicillin and required eradication of the mastoid and extradural foci to effect a cure. Penicillin was not used intrathecally, and this may be significant in light of the progress of the case and the following discussion.

Without exception all who have written on the subject of otogenous meningitis ascribe first place in therapy to removal of the causal focus. What Thornell and Williams [13] have written about apical petrositis applies as forcefully to all temporal-bone suppurations complicated by meningitis.

After the meningitis has been brought under control, it then is necessary to eradicate the disease in the petrous pyramid surgically, because unless this is done the infected focus may lie dormant, protected by a layer of necrotic material and pus to become reactivated after the withdrawal of chemotherapy. No more important lesson can be taught than the inadequacy of chemotherapy alone to clear up foci in the petrous pyramid.

The only exception to this is meningitis appearing very early in the course of an acute ear infection. Dysart [14] has stated that "it is generally accepted that meningitis occurring in the first few days of otitis media is probably of thrombophlebitic origin and not from direct necrosis. Therefore mastoidectomy is not indicated in the early cases." There is likewise unanimity concerning the necessity of antibiotics and/or chemotherapy. But opinions differ regarding the use of therapy intrathecally. Sweet and others [15] and Siegal [16] and others have reported neurogenic bladder disturbances, transverse myelopathy, paraplegia, convulsions, and persistent headache after penicillin intrathecally. Penicillin sodium, 10,000 units per cubic centimeter, applied to the brain causes microscopically visible hemorrhages, and microscopically one can see areas of cortical degeneration.

Nevertheless, from a study of the literature, men who have had many cases use and plead for the use of penicillin intrathecally and some, as White and others,[17] feel that the cisternal route is preferable. Rudberg and Sjoberg [18] state that clinical experiences show that one cannot avoid the intrathecal administration of penicillin

13. Thornell, W. C., and Williams, H. L.: Apical Petrositis, Arch. Otolaryng. **43**:393 (April) 1946.

14. Dysart, B. R.: Otitis Media and Complications, Arch. Otolaryng. **48**:609 (Nov.) 1948.

15. Sweet, L. R.; Dinnoff-Stanley, E.; Dawling, H. F., and Lepper, M. H.: The Treatment of Pneumococcic Meningitis with Penicillin, J. A. M. A. **127**:203 (Feb. 3) 1945.

16. Siegal, S.: Transverse Myelopathy Following Recovery from Pneumococcic Meningitis, J. A. M. A. **129**:547 (Oct. 20) 1945.

17. White, W. L.; Murphy, F. D.; Lockwood, J. S., and Fleppin, H. F.: Penicillin in the Treatment of Pneumococcal, Meningococcal, Streptococcal and Staphylococcal Meningitis, Am. J. M. Sc. **210**:1 (July) 1945.

18. Rudberg, R., and Sjoberg, A.: On Prognosis and Therapy in Otorhinogenous Meningitis, J. Laryng. & Otol. **63**:446 (Aug.) 1949.

in otorhinogenous purulent meningitis. Rammelkamp and Keefer [19] have shown that intrathecally injected penicillin diffuses throughout the ventriculoarachnoid space and that significant amounts remain in the spinal fluid for 24 hr. Most workers in the field state that not more than 10,000 units should be used at a time, in concentrations of 1,000 units per cubic centimeter. There is considerable unanimity in the opinion that at the onset of meningitis these spinal injections should be given twice daily and that treatment should not be terminated too soon.

The use of sulfonamide preparations, because of their diffusibility into the cerebrospinal system, is an important adjunct in treatment. Other antibiotics should be used when causative organisms are found to be sensitive to them.

We did not use intrathecal therapy in this case, and the patient lived. It is possible that had we employed this additional treatment, recovery would have been more rapid and the spinal fluid would have returned to normal more quickly.

CONCLUSIONS

Four cases of otogenous intracranial complications are reported.

The antibiotics and sulfonamides play a lifesaving role in these conditions, though their use may mask diagnostic signs and delay surgical treatment. Delay in surgical treatment of these complications is dangerous.

Surgical removal of the causal focus is as essential to the cure of otogenous intracranial complications now as before the advent of sulfonamides and the antibiotics. These drugs alone cannot cure an established otogenous intracranial complication.

19. Rammelkamp, C. H., and Keefer, C. S.: The Absorption, Excretion and Distribution of Penicillin, J. Clin. Investigation **22**:425 (May) 1943.

Case Reports

ELONGATED STYLOID PROCESS WHICH INTERFERED WITH FUNCTION OF A SINGER'S VOICE

Operation and Recovery

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THE STYLOID process develops, along with the stapes, the stylohyoid ligament, and the anterior horn of the hyoid bone, from the cartilaginous core of the second branchial arch, or cartilage of Reichert, the embryonic hyoid-arch cartilage.

This cartilage is composed of four parts: 1. The tympanohyal part is cuplike and grows from the periotic capsule. 2. The stylohyal part forms the styloid process. 3. The ceratohyal portion takes a regressive development into the stylohyoid ligament. 4. The hypohyal part forms the lesser cornu of the hyoid bone.

Ankylosis usually occurs in adult life between the tympanohyal and the stylohyal parts. The union of these two parts constitutes the styloid process of adult life.

Dwight, the anatomist, stated that Reichert's cartilage in early embryonic life extends downward and forward from the base of the skull toward its fellow of the opposite side, to which it is connected by the crosspiece of the basihyoid or hypohyoid. This basihyoid later becomes the body of the hyoid, hyoid meaning U-shaped.

JOINTS

Van Eicken stated that as long as the passive mobility of the styloid rod is preserved symptoms will not occur. As long as the loose, fibrinous connections between the four original aforementioned portions remain intact, the long process will remain symptomless. Ossification of these joints will change the four links of the styloid chain into a stiff, bony rod, extending from the base of the skull to the hyoid bone. This hard mass will become an obstacle and will elicit the various symptoms of discomfort.

COMPARATIVE ANATOMY

Studies in comparative anatomy show that the longated process is a form of atavism. In certain groups of animals the ceratohyal portion does not undergo the regressive metamorphosis into the stylohyoid ligament of man. On the contrary, it is transformed from the embryological cartilage into the bone.

Thus, the styloid process forming a portion of the tonsillar bed is the normal feature and seems to have the function of supporting the muscles of deglutition.

Read before the Clinical Conference at the Manhattan Eye, Ear and Throat Hospital, New York, March 8, 1951.

ANATOMICAL ASPECTS

The average process is 2.5 cm. in length, longer in 4% of cases, springing from the petrous portion of the temporal bone just in front of the stylomastoid foramen, and going downward, forward, and inward.

The muscles connected are (1) the styloglossus (hypoglossal nerve supply); (2) the stylohyoid (facial nerve supply); (3) the stylopharyngeus (glossopharyngeal nerve supply).

The ligaments connected are (1) the stylohyoid to the lesser cornu of hyoid bone; (2) the stylomandibular to the angle of the mandible; (3) the stylopharyngeal, or fascia alaris, to aponeurosis with the posterior pharyngeal wall.

The styloid has to be 4.5 to 5 cm. long to reach the tonsil.

The nerves associated in the styloid syndrome are four cranial nerves. The ninth nerve is most affected, the fifth occasionally, and the seventh and the 10th nerves rarely.

ARTERIES

The internal and external carotid arteries may be affected by the elongated styloid process, causing pain along the routes of the arteries and presenting the much debated "styloid process-carotid artery syndrome" of Eagle.[1]

SYMPTOMS

The symptoms of this syndrome are (1) long-continued pain in the throat after tonsillectomy; (2) a sensation of a foreign body in throat—as cotton, wood, metal; (3) difficulty in deglutition; (4) otalgia; (5) pain along the distribution of internal and external carotid arteries; (6) upper and lower head pain.

DIAGNOSIS

Differential Diagnosis.—The syndrome must be differentiated from glossopharyngeal neuralgia, histamine sensitivity, migraine, sphenopalatine neuralgia, temporomandibular joint syndrome, unerupted or impacted molar, etc.

Diagnosis.—The syndrome can be diagnosed by (1) palpation; (2) inspection of throat; (3) pressure over the carotid artery by a finger in the throat and external pressure on neck; (4) history; (5) roentgenograms (anteroposterior and lateral); (6) angiograms. Tonsillectomy is not always in the history.

REPORT OF CASE

R. F., a white man, aged 27, a professional operatic singer and vocal pupil, appeared Jan. 25, 1950. His chief complaint was inability to sustain top notes. He complained of fatigue on using his throat muscles, lumps in his throat, and difficulty in closing off his nasopharynx.

The personal family history was irrelevant. The results of physical examination were normal. The Wassermann test had a negative reaction.

History of Present Condition.—There was no prolonged discomfort after tonsillectomy 15 years before. The first symptom appeared about a year ago, when he noted that he had difficulty in producing or sustaining the eight upper notes of his vocal register. He was a tenor, and his voice meant very much to him. The voice would go off-key or crack in the attempt to sustain a note, particularly after he had sung any length of time. He felt he did not have enough space in his mouth. While he had difficulty in closing off the nasopharynx, fluids did not go into his nose.

1. Eagle, W. W.: Elongated Styloid Process: Further Observations and a New Syndrome, Arch. Otolaryng. **47**:630 (May) 1948.

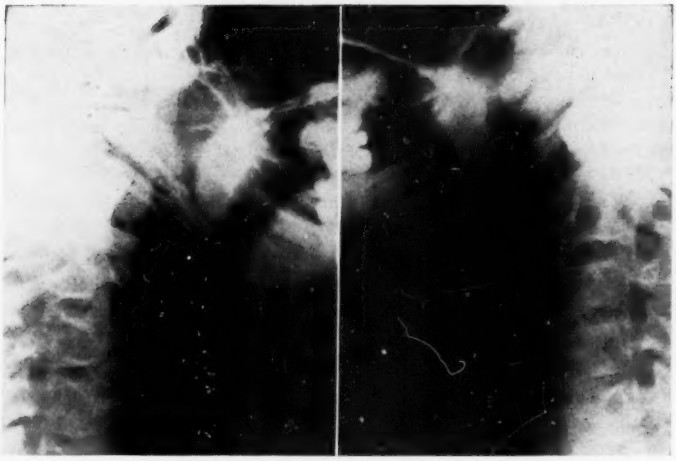

Fig. 1.—Roentgenograms of left and right sides made on Feb. 1, 1950, before operation.

Fig. 2.—Photographs made on March 17, 1950, before operation.

As the symptoms became worse, large lumps in the throat were noticed. In the last year or so they seemed to be getting larger.

He was advised to have a secondary tonsillectomy by various physicians and surgeons. Examination elicited no tenderness over either carotid artery. What was found is best shown in the illustrations. The larynx and sinuses were normal, and the tips of both styloid processes could be felt in the throat easily.

On March 20, 1950, with the patient under general anesthesia, I made long incisions over both styloid processes and dissected back the tissues and muscles after cutting the stylohyoid ligament. I used the Faulkner ring curet. After that, I tied a black silk thread on the tip of

Fig. 3.—Postoperative view, made on Oct. 31, 1950.

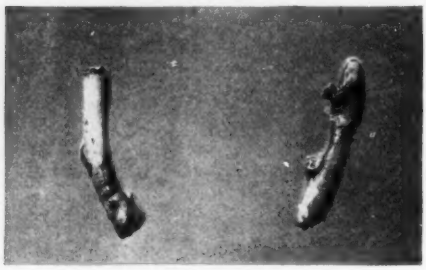

Fig. 4.—Actual size of pieces of ossified stylohyoid ligament removed from left and right sides at operation. Picture was made in June, 1951.

each styloid process so that they could not be lost down in the trachea or pulled back by the muscles of the throat to which they may have been attached. I removed 2.5 cm. of exposed bony rod but did not close the wound.

Postoperative Course.—A short time after operative healing, the tension in the patient's throat disappeared, and he experienced no tiring after three hours of singing. He now can close off the nasopharynx without effort. There is no more cracking of the voice, hoarseness, inability to sustain top notes, or lumps in throat. His voice is now what he wants it to be, and he can continue his singing career.

COMMENT

There are probably many cases like the above, but I have found none on record. Even though reports cannot be found in the literature, these anomalies do happen. In any case in which the long styloid process affects the voice or keeps the nose from being closed off from the throat, I feel it makes no difference whether the styloid process or the ossified stylohyoid ligament is shortened so long as the end is attained for which the operation was performed.

I feel that the interesting part of this case, as shown on the roentgenogram, was that I did not shorten any of the styloid process itself but took a piece from the stylohyoid ligament which had been calcified. It is difficult to tell the ossified ligament from the styloid process except when the location of the joint between the styloid ligament and the styloid proper is shown on the roentgenogram, as described previousiy. All these things were joined together.

I did not take more than 1 in. (2.5 cm.) of the bony tissue away, because, after taking that amount, I felt that the whole pharynx and throat was loose. Removal of this amount seemed sufficient. A good result was attained.

Clinical Notes; New Instruments and Techniques

NASOFORM SPLINT

An External Nasal Splint for General Use

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Inadequate reduction of nasal fractures is fostered by the lack of simple standardized methods and equipment. One common obstacle is the difficulty in securing adequate immobilization after reduction. Fixation of nasal bones requires very accurate contour splinting, probably more so than any other fracture site except the jaws. Internal fixation can be accomplished by judicious packing, but external splinting requires "custom built" or individually "fitted" appliances for the widely variable shapes and sizes of nasal framework encountered.

Any one of many splinting techniques employed after nasal plastic operations may be used for immobilizing nasal fractures. The commonest of these utilize clamps with mechanical adjustments and splints made of dental wax or malleable sheet metals.[1] Unfortunately, most of these appliances are not sufficiently simple or universally applicable to be attractive for general use. It is the purpose of this paper to describe a simple external nasal splint, which I have been using and modifying for many years. In my experience it has been highly satisfactory both for nasal plastic surgery and for all but the most complicated of nasal injuries. I believe that it is practical and convenient for general use and that it could be readily adapted to commercial production. It has been designated as the "Nasoform Splint."

CONSTRUCTION OF THE NASOFORM SPLINT

This splint is not entirely original. Its predecessor was one designed and used by Bames [2] with modifications by Straith.[1d] Fundamentally, it is a padded sheet-aluminum splint which is bent to conform to any desired shape (Fig. 1). Lateral flanges stabilize the splint on the cheeks, and the splint is secured in position by a tape and buckle which are fastened around the neck. Adhesive plaster fastened to the forehead prevents the splint from sliding downward.

These splints are made by my nurse from 23-gauge soft-sheet aluminum (Fig. 2*A* and *B*). The blanks (about 12 cm. by 4.5 cm.) are outlined with a template and are cut with a small pair of tin snips. The blank is glued with rubber cement to a piece of cellular latex (about 3/16 in. thick), and overlapping excesses of rubber are trimmed away with scissors. The outer surface of the aluminum is covered with adhesive plaster, and over this a strip of 3/4-in. twill tape is fastened horizontally with rubber cement. To one end of the tape a vest buckle is then stitched or stapled.

USE OF THE NASOFORM SPLINT

At the operating table the splint can be bent to any shape desired by finger pressure (Fig. 2*C*). It is first flexed vertically along the midline to form a rounded curve to fit the bridge of the nose, with avoidance of the formation of sharp creases toward which the metal tends. Secondly, the lateral flanges are bent upward on either side (Fig. 1), with the width of the flanges depending upon the height of the nasal bridge. For low bridges, wider flanges will be left than for high ones. A strip of 2-in. adhesive plaster is applied vertically to the outer surface (for attachment to the forehead), and notches are cut where the plaster would interfere with vision.

From the Department of Surgery, University of Buffalo School of Medicine.

1. (*a*) Blair, V. P., and Brown, J. B.: Deformities of the Nose, Remodeling and Repairs, in Piersol, G. M.; Bortz, E. L., and others: The Cyclopedia of Medicine, Philadelphia, F. A. Davis Company, 1935. (*b*) Joseph, J.: Nasenplastik und sonstige Gesichtsplastik, Leipzig, Curt Kabitzsch, 1928. (*c*) Safian, J.: Corrective Rhinoplastic Surgery, New York, Paul B. Hoeber, Inc., 1935. (*d*) Straith, C. L.: Personal communication to the author. (*e*) Straith, C. L., and De Kleine, E. H.: Modern Management of the Fractured Nose, Internat. Abstr. Surg. **66**:9-15, 1938; in Surg. Gynec. & Obst. (Jan.) 1938.

2. Bames, H. O.: Personal communication to the author.

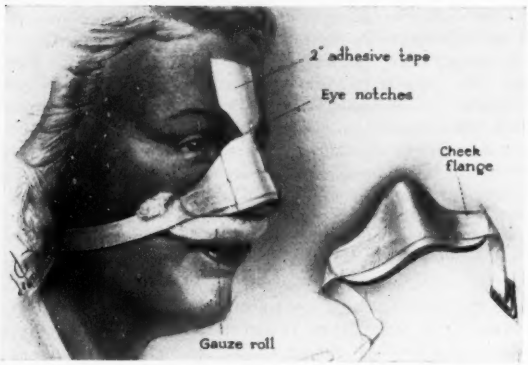

Fig. 1.—Splint in position.

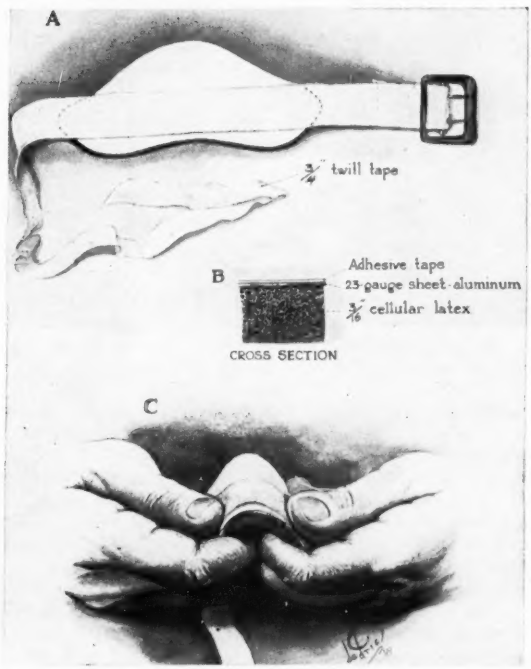

Fig. 2.—Parts of splint showing method of construction and shaping.

The splint is then applied to the nose and minor adjustments made by further bending. Compression of the two sides gives a tight fit and assists in maintaining the narrowing attained by reduction (or osteotomies in nasal plastic surgery). The flanges should be adjusted to lie flat on the cheeks, not only to stabilize the splint but also to exert firm pressure over the angular vessels (external maxillary artery and anterior facial vein). This is of considerable help in the control of bleeding. For very short noses it is occasionally necessary to trim away a bit of the splint (with tin snips) in the midline at its lower margin. In fastening the buckle and tape around the neck, the tension may be adjusted as desired. It is important to make this adjustment with the head in a normal vertical position. As the chin is lowered the strap will be loosened and with elevation it will be tightened, so it is essential to make adjustments with the head in the position in which it is normally carried. Generally I tuck a roll of gauze under the nasal tip to take care of bleeding encountered in such cases. If the ends of the gauze are secured under the straps of the splint, replacements can be made very simply—even by the patient himself.

APPLICATIONS OF THE NASOFORM SPLINT

In my experience this splint has been very suitable for nasal plastic surgery in which the size of the nose is reduced or in which lateral deviations are corrected. It has been equally satisfactory in the building up of the nasal contour with cartilage grafts and in the reduction of recent

Fig. 3.—Use of the "Nasoform Splint" for rhinoplasty. After osteotomies, the nasal bones are freely movable and must be immobilized as for accidental fractures.

nasal fractures. Occasionally it is used as a pressure dressing when skin plastic surgery, grafts, and flaps are used in the regions of the nose. In the past 10 years I have used it in over 2,000 cases in these categories.

The largest group in which this splint has been employed has been the typical rhinoplasties for the removal of humps, the elevation of overhanging nasal tips, or a combination of the two (Fig. 3). In such patients it has been highly satisfactory for reapposition of undermined skin to the nasal framework, for helping in the control of bleeding, and for immobilization of nasal bones after lateral osteotomies. In the latter application, I have found very little tendency for the nasal bones to spring back toward their previous position if they are very freely fractured from all attachments. The use of mechanical clamps and other appliances after the first week has been unnecessary, and their use has been completely discarded.

When cartilage grafts are inserted into the nasal bridge, this splint is an ideal pressure dressing for obliterating dead spaces in the subcutaneous tissue overlying the graft. These spaces, if not kept compressed, allow the collection of fluid from foreign-body reaction, from infection, or from any bleeding which may occur postoperatively. In these cases I generally keep a splint in place for one week unless there is a serous-fluid collection. In that event, I keep the splint in place or reapply it until there is no further fluid accumulation. By this means I have had an exceptionally low rate of difficulties due to such reactions.

In the handling of recent nasal fractures or lateral deviations of the nasal bridge from old healed fractures, I also use this splint to immobilize the nasal bones in a normal midline position after reduction or osteotomies have been completed. In such cases it is well to overcorrect the deviation (particularly in old healed fractures) and to maintain a slight overcorrection by bending the splint accordingly. In badly comminuted nasal fractures, a small amount of packing between the septum and the nasal bone is often used in conjunction with external splinting. This is particularly useful when one or both nasal bones are displaced inward toward the midline. In these cases, the splint should not be compressed too tightly, since it acts only as a protection. In major facial fractures involving the malars and maxilla, whereby the normal basal support of the nose is severely damaged, more elaborate apparatus of wiring and plaster head caps may be required,[1e] since this splint depends upon stability against the cheeks. The simplicity in the use of this nasal splint should make it adaptable for physicians in various branches of medicine for more adequately reducing and immobilizing nasal fractures.

SUMMARY

1. The "Nasoform Splint" is for general usage in nearly all types of nasal fractures and nasal plastic operations.

2. This splint is made of sheet aluminum and padded with cellular latex and is attached in position by means of a tape around the neck and adhesive plaster attached to the forehead. Its construction is simple enough to be carried out by a nurse and would be readily adaptable to commercial production.

3. At the operating table this splint is molded by finger pressure to any desired shape for the particular nose and the procedure being undertaken. Its application and accurate fitting are very easily carried out.

4. This splint is useful in rhinoplasties for reduction in the size of the nasal framework, for the insertion of cartilage grafts to build up the nasal framework, for most nasal fractures, and for miscellaneous types of skin plastic surgery over the nose. In more than 2,000 such cases, it has been found uniformly satisfactory.

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NEW IRRIGATOR FOR USE IN TEMPORAL BONE SURGERY

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In order to perform temporal bone surgery satisfactorily, it is necessary to irrigate the operative cavity frequently as the operation progresses. Most irrigators, whether of the metal-valve variety or of the type that depends upon collapse of a rubber tube, have proved to be unsatisfactory. As the result of repeated sterilization, both types of irrigators soon begin to leak and, consequently, enhance the possibility of field contamination. This same difficulty is

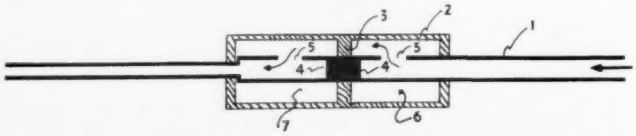

Fig. 1.—Cross section sketch of irrigator: *1*, hollow metal tube; *2*, rubber sleeve; *3*, rubber ring; *4*, metal block; *5*, perforations; *6*, proximal chamber, and *7*, distal chamber.

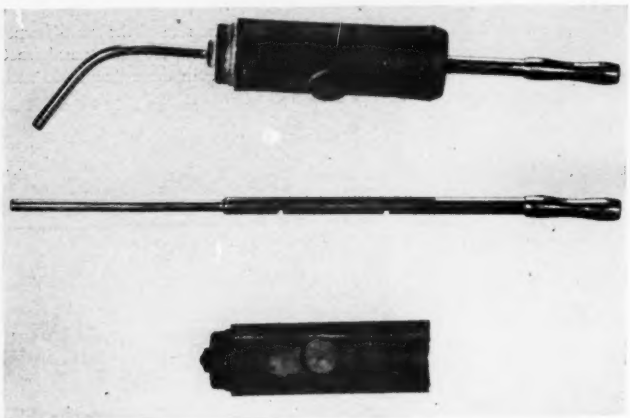

Fig. 2.—Photograph showing two parts of irrigator separately and assembled.

encountered when one uses a rubber-bulb type of irrigator. As the result of my displeasure with these various types of irrigators, the Surgical Mechanical Research Company worked with me in developing what I consider to be a satisfactory irrigator.

Basically, the irrigator consists of a hollow metal tube covered by a rubber sleeve. The rubber sleeve is divided into two chambers by a rubber ring. The hollow metal tube is blocked at its center so that the solution cannot flow directly through. On each side of this block there is a perforation in the metal tube. The rubber ring, with a hole in its center to allow for the introduction of the metal tube, is so spaced that it falls at about the point where the metal tube is blocked. With the metal tube in place the rubber sleeve is divided into two noncommunicating chambers.

Fluid can enter and fill the proximal chamber but cannot pass through the blocked metal tube or pass by the rubber ring, which hugs the metal tube closely. However, if this ring is

distorted by squeezing the outside of the rubber sleeve, the opening in the rubber ring becomes oval instead of round and stands away from the metal tube. This allows the fluid to pass around the blocked portion of the metal tube, into the distal chamber of the rubber sleeve where it communicates with the perforation of the metal tube, and out through the open end of the irrigator.

The basic trouble in all previous irrigators with which I am familiar was the difficulty in making the packing around the valve airtight. When the air leaks into the system, it displaces a droplet of fluid from the outlet of the irrigator. It is in order to overcome this air and liquid leakage that some designers have made irrigators which depend upon pinching off a rubber tube. This new device depends upon the natural resilience of the rubber to cut off the flow of liquid.

This new irrigator will not drip and seals the water immediately when the finger pressure is relieved. It is self closing and has no mechanical moving parts. It requires no packing, has no springs or corroding mechanism, and can be sterilized or autoclaved repeatedly without harm. The only part of this irrigator that may deteriorate with age is the hollow rubber barrel, which may be easily replaced.

This irrigator is also of value in doing caloric testing. It is compact and is operated simply by pressing on the center of the rubber barrel to start the flow of solution, which is stopped immediately upon relieving the pressure on the center of the rubber sleeve.

Progress in Otolaryngology

Summaries of the Bibliographic Material Available in the Field of Otolaryngology for 1949 and 1950

TONSILS AND ADENOIDS

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INDICATIONS

ALTHOUGH there is over-all agreement for the most part with regard to the indications for tonsillectomy or adenotonsillectomy, this subject continues to provide a great deal of discussion in the literature on tonsils and adenoids.

Swanberg [1] points out that a large per cent of all surgical procedures in this country are done on tonsils and adenoids and states that the present hospital bed shortage might well be alleviated if strict adherence to present-day indications were insisted upon by physicians and hospital authorities. Lederer and Grossman [2] advocate waiting, whenever possible, until the child reaches the age of 5 yr. or more before doing adenotonsillectomy, since they believe that the tonsils play an important part in autovaccination and the defense mechanism. They also point out that hypertrophy alone does not constitute an indication for removal and that hypertrophy is frequently a prominent part of the allergic state.

Clein [3] points out that the removal of adenoids and tonsils will not alter the course of a patient's allergy and, in fact, many complaints such as frequent colds, mouth breathing, nasal stuffiness, and chronic cough, which are often attributed to diseased tonsils or adenoids, may be due to an allergy. When adenotonsillectomy is performed in allergic children, he states, regrowth of the structures occurs much more frequently in those whose allergy remains untreated. According to Feingold,[4] edema is the principal factor in enlargement of the tonsils in allergic children, and he emphasizes that hypertrophy alone is never an indication for tonsillectomy in the absence of obstruction of the air or food passages. If there is actual infection of the tonsillar tissues and allergic management does not suffice to clear up the symptoms, then adenotonsillectomy is advised, but the fact should be kept in mind that surgery alone will not suffice to clear up all the symptoms in an allergic patient. Lederer and Grossman [2] also have pointed out the importance of allergy in the prospective tonsillectomy patient.

From the Department of Otolaryngology, Southwestern Medical School of the University of Texas.

1. Swanberg, H.: Removal of Children's Tonsils and Adenoids, Mississippi Valley M. J. **72**:103, 1950.

2. Lederer, F. L., and Grossman, A. A.: The Otolaryngologist Looks at the Tonsil and Adenoid Problem, Eye, Ear, Nose & Throat Month. **28**:577, 1949.

3. Clein, N. W.: Allergy and the Tonsil Problem in Children, Ann. Allergy **7**:329, 1949.

4. Feingold, B. F.: Tonsillectomy in the Allergic Child, California Med. **71**:341, 1949.

Boutourline-Young [5] points out that there is a physiological enlargement of the tonsils about the age of 6 yr. and that this does not constitute an indication for removal and should not be confused with a pathological state in the organ. He states that although the function of the tonsil remains obscure there are numerous opinions in support of its function as a useful organ and one should consider carefully the indications for surgery without regard for the size. In properly selected cases, adenotonsillectomy produces brilliant results but in many it constitutes a drawback. In some controlled studies, children who have had their tonsils and adenoids removed have had a greater incidence of bronchitis but fewer cases of tonsillitis than a similar control group. He sums up the problem by saying that "the best indication for operation is several repeated attacks of tonsillitis, not obviously deriving from without, and coupled with enlargement and tenderness of the cervical glands. The teeth and sinuses should be excluded as foci of infection."

Walker and Copeland [6] in discussing the problem from the standpoint of the otolaryngologist and the pediatrician, respectively, seem to have reached a practical unanimity of opinion. Walker points out the complexity of the problem, especially since the function of the tonsils is unknown. He indicates the probable function of immunity production in childhood and reminds the reader that children who have had early removal of tonsils and adenoids have a greater incidence of infections of the respiratory tract. Although disease processes in the tonsil may serve as a focus of infection, the usual process is restricted to the tonsillar tissues. It usually involves all the parts of the tonsil but may extend to the adjacent peritonsillar tissues. In any case, the condition of the Eustachian tubes, ears, nose, sinuses, chest, and cervical nodes must be evaluated, often with the aid of the pediatrician who sees the child through repeated infections. There is a threefold aim in the treatment of diseased tonsillar structures: (1) the elimination of infection, (2) the correction of secondary effects of disease upon adjacent tissues, and (3) the reestablishment of the well-being of the child.

With regard to adenoidectomy, Walker states that there is no age limit. The effects of disease or hypertrophied adenoid tissue are usually worse than the operation, so it should be undertaken as soon as the indications are present. In cases of only partial obstruction of the nasopharyngeal airway by adenoid tissue, often proper treatment of nasal infection will suffice to relieve the symptoms. The treatment of nasopharyngeal lymphoid tissue by irradiation has been overdone of recent years. Walker also mentions the importance of the psychic factors involved and advises that adenotonsillectomy at best is not a simple procedure and should not be undertaken lightly. From the standpoint of the pediatrician, Copeland divides the indications for the operation into those showing a need for the mechanical relief of obstruction and the common indications. The former include obstruction to sinus drainage, Eustachian-tube blockage, and interference with deglutition and respiration. Among the common indications he lists (1) frequent recurring attacks of tonsillitis, (2) chronically infected tonsils, with or without septic involvement, (3) tonsillar abscess, especially when recurring, (4)

5. Boutourline-Young, H. J.: The Significance of the Tonsils in Pediatrics, Med. Illust. **3**:103, 1949.

6. Walker, A. A., and Copeland, E.: The Problem of Tonsilloadenoidectomy in Childhood, Clin. Proc. Child. Hosp. **6**:145, 1950.

chronic sinusitis, (5) cervical lymphadenitis with impending suppuration, and (6) the nephritides.

As regards asthma as an indication for tonsillectomy, Hedström,[7] after pointing out that there are differences of opinion on the subject, reports the results in 52 asthmatic patients who underwent tonsillectomy. Of these, eight showed some improvement, four had exacerbations of the asthma after the operation, and the remaining 40 showed no change. He concludes from this study that tonsillectomy has no appreciable effect upon asthmatic conditions.

In a general discussion of the tonsil and adenoid problem, Illingworth, Macbeth, and others [8] discuss the indications. Illingworth lists the following conditions: (1) the conditions present under which the physician would perform the operation on his own child, (2) frequent (two to three times annually) attacks of tonsillitis, (3) previous peritonsillar abscess, (4) rare respiratory obstruction due to size of tonsils, and (5) diphtheria carriers when all other measures have failed. He states that the operation is rarely indicated before the age of 6 yr. but that adenoidectomy must be done at any age at which the proper indications are present. Macbeth states that the performance of tonsil surgery should be restricted to those who are specially trained to do it. He lists five absolute indications: (1) more than two attacks of acute infection, (2) quinsy, (3) persistent cervical-gland enlargement without nasal sinus disease, (4) obstruction of air or food passages, and (5) tuberculous adenitis. (He believes that the organisms gain entrance through the tonsil.) All the discussers emphasize that the size of the tonsil has nothing to do with the indications for its removal in the absence of obstruction.

Acute infections of the peritonsillar tissues have never constituted a widely popular indication for surgical intervention in this country. An article by Virtanen [9] on the subject may be of some interest in a discussion of the indications. He reports 379 cases of peritonsillitis in which tonsillectomy was done during the acute phase. The surgery was done under local anesthesia in adults and under ether anesthesia in children. Abscess was found in 80.4% of the patients, phlegmon in 9.2%, infiltration in 5.5%, and granulations or necrosis in 4.9%. The operative findings revealed that in 32.5% conditions were unsuitable for incision and drainage because of atypical location of the abscess or absence of abscess formation. The disease was bilateral in 14.4% of the patients, and bilateral tonsillectomy was done in this group as well as in 74.4% of the patients with unilateral disease. In those without any preoperative complications (364 cases), 95.3% were afebrile four days after the operation. Postoperative hemorrhage occurred in six (1.6%). Five patients had bronchitis postoperatively and one had pneumonia. Fifteen patients in the series had preoperative complications. Five of six patients with septic fever died. Parotitis was present in six, three of whom required incision and drainage of a parotid abscess and three of whom recovered after tonsillectomy without further measures. Three had phlegmon of the larynx and floor of the mouth and required external operation. Virtanen summarizes by saying,

7. Hedström, V.: Experiences of Tonsillectomy in Bronchial Asthma, Acta allergol. **3**:147, 1950.

8. Illingworth, R. S.; Macbeth, R. G.; Hadfield, E. H., and Stevenson, R. S.: Discussion of the Tonsil and Adenoid Problem, Proc. Roy. Soc. Med. **43**:317, 1950.

9. Virtanen, V. S.: Tonsillectomy as Treatment of Acute Peritonsillitis with Clinical and Statistical Observations, Acta oto-laryng. (Supp. 80) **37**:9, 1949.

Abscess tonsillectomy is a correct and serviceable measure of treatment which does not involve any greater risks for the patient than other surgical measures. In the treatment of acute peritonsillitis, in all stages of this condition, abscess tonsillectomy is an excellent operation.

PSYCHOLOGICAL ASPECTS

More and more emphasis is being placed on the psychic trauma which may result from tonsil and adenoid surgery in children. One unusually severe case has been reported [10] in a 10-yr.-old boy who was in the midst of a neurotic conflict when adenoidectomy was performed. He was presented to a clinic in psychosomatic problems in which the discussion included points of importance in the mother-child relation and the family-hospital relation. This particular case may be applied to the problem as a whole in only a general manner, since both mother and child were under unusual psychodynamic tensions at the time the operation was advised and undertaken.

Jessner and Kaplan [11] studied a group of children upon whom adenotonsillectomy was performed and concluded from the viewpoint of the psychologist that all the children in their group experienced some degree of anxiety in connection with the operation but most of them were able to tolerate the experience without any lasting emotional sequelae. Those who did have disturbing reactions were, for the most part, children who already had neurotic problems or were under emotional tensions. They offer several general suggestions which may be employed in avoiding psychic trauma. These include waiting until the child reaches a favorable age for the operation, presumably 5 to 7 yr., postponement of the operation if there has been recent emotional upset or traumatic experiences, proper emotional preparation of the patient by both parents and physician, the recognition of the symbolic value to the child of arbitrary or trivial requests, and finally, the maintenance of good ward morale and pleasant surroundings.

Coleman [12] also urges that the operation be planned for and anticipated through child and parent education since it is an elective procedure. He points out that many childhood and adult neuroticisms can be traced to poorly planned elective surgery and its psychic trauma and suggests that these psychological pitfalls may be avoided by the following steps: 1. The child should be given an explanation calmly and honestly of the need for the operation. 2. The child should be spared any tense discussions about it between the parents. 3. Surprise and confusion should be avoided by explaining about the operating room, nurses, etc. 4. The reason for the anesthesia should be explained. 5. The presence of one or both parents should be allowed at the induction of anesthesia and during the postanesthetic period. 6. The separation of child from parents should be attenuated, if the fifth suggestion is impossible, by the doctor himself accompanying the child to the operating room. 7. The child should be permitted to manifest his displeasure by vocalizing and verbalizing his hostility.

10. Clinic on Psychosomatic Problems: A Child's Reaction to Adenoidectomy, Am. J. Med. **9**:242, 1950.

11. Jessner, L., and Kaplan, S.: Observations on the Emotional Reactions of Children to Tonsillectomy and Adenoidectomy: A Preliminary Report, Tr. Conf. Prob. Infancy & Childhood **3**:97, 1949.

12. Coleman, L. L.: The Psychologic Implications of Tonsillectomy, New York J. Med. **50**:1225, 1950.

FOCUS OF INFECTION

In any consideration of tonsils, their role as a possible focus of infection deserves mention. Willcox [13] reviews the relation between tonsillar infection and various diseases such as the arthritides, recurrent upper-respiratory tract infections, rheumatism, bacterial endocarditis, ankylosing spondylitis, and hypothyroidism. In diseases of the upper respiratory tract, such as sinusitis, rhinitis, etc., he states that the tonsils definitely do serve as a focus of infection when they are chronically infected. In acute rheumatism, the disease is so often ushered in by or accompanied by tonsillitis that some consider it a part of the disease. In those cases, recurrent tonsillitis or signs of chronic infection are indications for removal of the tonsils. In bacterial endocarditis, an occasional association with tonsillar disease is reported but relation to septic dental conditions and extractions is more usual. Bright's disease has been shown to be hematogenous infection of the kidney from other sources and the tonsils have been involved often. However, when the chronic stage is reached, irreversible changes have already taken place in the kidney and removal of infected tonsil tissue is of no avail. In summary, Willcox states that the focus-of-infection concept is still alive but on a much more balanced basis than when first propounded. The tonsils are less frequently implicated than are the teeth as foci, and the paranasal sinuses should not be overlooked. Chemotherapy and antibiotics are mentioned as being important in suppressing tonsillar infections and the possible effects thereof on other tissues.

Michael,[14] in discussing the relation between the lymphoid tissue of the upper respiratory tract and streptococci and the effect of this relation upon recurrent streptococcal sore throat, rheumatic fever, and glomerulonephritis, states

> Patients with repeated episodes of acute severe sore throats can be expected to have a decreased number of attacks after tonsillectomy. The available evidence does not indicate that tonsillectomy will prevent or will appreciably alter the course of acute rheumatic fever or of acute glomerulonephritis, or that it will diminish the incidence or recurrence of these diseases.

A relation between nasal carriers of streptococci and tonsillitis is pointed out by Cook and Munro-Ashman.[15] They studied a group of school boys from a clinical and bacteriological standpoint and found that most of the ones with streptococcic tonsillitis came from dormitories in which there were carriers of large amounts of the organisms in the nasal passages. Emphasis is placed upon the importance of bacteriological studies in controlling epidemics of streptococcic tonsillitis.

MacDonald [16] reviewed all the cases of tonsillitis, rheumatic fever, and scarlet fever occurring in the British R. A. F. and W. A. A. F. personnel from 1938 through 1947 in an attempt to correlate the incidence of each disease with that of the others. Since tonsillitis is not a reportable disease in the general population, it was thought that such a study might be of significance in relating tonsillitis to the other diseases. His conclusion is that tonsillitis figures are of little or no value in predicting a rise in the rheumatic-fever rate but that one may expect about as many cases of rheumatic fever as scarlet fever in the adult population.

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13. Willcox, P. H.: The Tonsil as a Focus of Infection, Med. Illust. **3**:57, 1949.

14. Michael, M., Jr.: The Role of Tonsillectomy in the Management of Recurrent Streptococcal Sore Throat, Rheumatic Fever and Glomerulonephritis, Am. J. Med. **6**:462, 1949.

15. Cook, G. T., and Munro-Ashman, D.: Nasal Carriers and Streptococcal Tonsillitis, Brit. M. J. **1**:345, 1949.

16. MacDonald, T. C.: Scarlet Fever and Tonsillitis in Relation to Acute Rheumatism, Brit. M. J. **1**:992, 1950.

Pentti [17] presents the results of bacteriological and histological studies of removed tonsils in 30 soldiers with cervical-node tuberculosis. In only one was tonsillar tuberculosis present, and he presumes that in all probability it was hematogenous. His conclusion is that cervical-node tuberculosis is most frequently secondary (hematogenous), at least in adults, and that in Finland where bovine infection is rare, primary tonsillar tuberculosis is rather rare.

The relation between tonsillitis and asthma has already been mentioned.

ANESTHESIA

Anesthesia for tonsillectomy and adenoidectomy continues to stimulate more discussion and occupy more pages than does the technique for the operation. Belton and Leigh [18] in a comprehensive consideration of the subject warn that adenotonsillectomy anesthesia is decidedly not "simple" or "minor," despite the frequency with which it is carried out. They call attention to the fact that adenotonsillectomy is by far the most frequent operation on children under general anesthesia. They also state that between 1922 and 1931, 15% of all the deaths due to anesthetics in the United States were in adenotonsillectomy. In order to be satisfactory, the anesthetic for tonsillectomy in children should provide the greatest patient safety with the least amount of unpleasantness, combined with proper working conditions for the surgeon. Speed of induction, choice of induction anesthetic, proper preoperative medication, and the maintenance and protection of adequate airway are all important factors which deserve careful consideration. Belton and Leigh prefer vinyl ether (vinethene®) to chloroform or ethyl chloride as an induction agent since it does not sensitize the heart to the action of epinephrine and thus dispose the patient to possible cardiac arrest or ventricular fibrillation. They describe their method of intratracheal intubation after induction, the use of a soft rubber or plastic tube inserted through a laryngoscope, and cite as advantages the freedom from worry about the airway as well as better control over the depth of the anesthesia. They also mention the dangers accompanying the intubation, such as laryngeal trauma and subsequent swelling from improper insertion or the insertion of too large a tube, use of too long a tube and obstruction of one of the main bronchi, damage to other soft structures from rough laryngoscopy, and accidents from improper attention to the valve mechanisms of the setup. They feel that better anesthetic methods and better trained anesthetists are reducing deaths due to anesthetics in medical centers to an insignificant number.

Owen,[19] in discussing tonsillectomy anesthesia, states that after 100 yr. ether still enjoys first place as one of the safest anesthetic agents for the maintenance of anesthesia. He discusses the various induction agents and endorses their use, as well as the use of preoperative medication. As children tolerate atropine well and tend to form more mucus than adults, he sees no advantage in cutting down the adult dose. The advantages and dangers of basal anesthesia in children are mentioned. He mentions that intratracheal intubation is still a controversial issue except when

17. Pentti, M.: Histologic Study of Removed Tonsils in Cases of Cervical Node Tuberculosis, Acta path. et microbiol. scandinav. **26**:603, 1949.

18. Belton, M. K., and Leigh, M. D.: Anesthesia for Tonsillectomy and Adenoidectomy in Children, M. Woman's J. **56**:15, 1949.

19. Owen, M. W. L.: Anesthesia for Tonsillectomy, Med. Illust. **3**:64, 1949.

adults are given general anesthesia, for which all agree that intubation is proper and indicated. He emphasizes the importance of postoperative care and states that it resolves itself principally about the maintenance of airway and close, continuous observation of the patient until full consciousness returns.

The use of general anesthesia in adults for the removal of tonsils has apparently received some stimulus from the increasing use of intravenously administered barbiturate anesthesia. Blaisdell [20] reports the use of thiopental sodium (pentothal sodium®) intravenously in 183 tonsillectomies in adults with no complications and suggests the following advantages of the method: (1) ease and simplicity of administration, (2) complete relaxation of the patient, (3) avoidance of the sense of suffocation by the patient, (4) speed of induction of the anesthesia, (5) avoidance of postoperative nausea and vomiting, and (6) long postoperative somnolence, obviating sedation. He also mentions two disadvantages. One is the necessity for careful hemostasis at the time of operation, since bleeding is greater than under local anesthesia, and the other is the danger of laryngospasm which is offset by the use of a Crowe-Davis-type mouth gag. This allows the operator to view the hypopharynx at all times, and with the head extended the blood and secretions gather in a pool in the nasopharynx. An airway must be used during the postoperative period and alert nursing at the bedside is necessary.

Griffiths [21] also reports a series of tonsillectomies in adults with thiopental sodium as the sole anesthetic agent. He used a 5% solution of the thiopental sodium in 220 patients who varied in age from 14 to 68. After premedication with omnopon® (a mixture of the hydrochlorides of the opium alkaloids) and scopolamine, the patients were given an induction dose in the anesthetic room. With the patients asleep, the transfer to the operating room was made and the patient placed in the Rose position. A needle was reinserted and the patient kept at the proper anesthetic level by repeated small doses of the drug during the operation. Oxygen was administered continuously. The Boyle-Davis mouth gag was used, and the surgeon carefully kept the pharynx clean of blood and secretions during the dissection. The importance of complete hemostasis is emphasized. Certain advantages are said to accrue to the surgeon, such as a completely motionless pharynx, more operating room than with an endotracheal tube, no vapors to inhale while working, less bleeding than with other general anesthetics, and a short induction time which allows him to do more operations during a given period of time. This method is not recommended by Griffiths for use in children, and the necessity for an experienced anesthetist is indicated.

Although intravenously administered barbiturates are not recommended for use in children, the use of tribromoethanol (avertin®) for a basal anesthetic has been reported by Yinger.[22] He reports its use in 3,042 cases in which it was given in the amount of 80 mg. per kilogram of body weight by rectum 20 to 30 min. before the time of operation. The advantages to patient and parent are pointed out. There were no bad effects noted except one case of allergy to the drug, and this compli-

20. Blaisdell, I. H.: The Use of Sodium Pentothal Anesthesia in Adult Tonsillectomies, Laryngoscope **59**:721, 1949.

21. Griffiths, H. F.: Sodium Thiopentone as the Sole Anesthetic Agent for Tonsillectomy in Adults, Lancet **1**:1109, 1950.

22. Yinger, S. C.: Tribromoethanol-Ether Anesthesia Used for Tonsillectomy and Adenoidectomy, Arch. Otolaryng. **50**:290 (Sept.) 1949.

cation responded well to the use of epinephrine by injection. Yinger also mentions the reduced amount of ether needed for maintenance of anesthesia when tribromoethanol as a basal anesthetic is used.

HEMORRHAGE

Postoperative bleeding continues in its position at the head of the list of complications following the removal of tonsils and adenoid tissue, and considerable study has been devoted to the prevention and control of this complication.

Jones [23] reports the incidence of secondary hemorrhage following tonsillectomy in 246 patients. In the first group of 75 patients there was no secondary hemorrhage. This group was allowed no acetylsalicylic acid at any time and received ascorbic acid and a synthetic vitamin K preparation postoperatively in every case and preoperatively in some cases. A sulfonamide powder was also insufflated onto the fossae postoperatively. This absence of postoperative bleeding is contrasted with two of 171 cases in the second group in which there was bleeding after the operation. This group differed from the first only in that acetylsalicylic acid was allowed. Jones believes, then, that the maintenance of the normal coagulating power of the blood by allowing no acetylsalicylic acid plus the avoidance of infection and the provision of vitamins C and K is important in reducing the incidence of postoperative bleeding.

Coombs [24] reports a similar study of 653 consecutive cases of adenotonsillectomy. In his series, the critical period was from the third to the ninth postoperative days, with most of the bleeding occurring on the fifth or sixth days. All of the patients received acetylsalicylic acid gum (aspergum®) three times daily (before meals). Of 164 patients receiving in addition 10 mg. of synkayvite® (the sodium salt of 2-methyl-1,4-naphthohydroquinone diphosphoric acid ester) three times daily, 12 (7.31%) had postoperative bleeding but only 5 (3.05%) required any intervention for its control. Of 310 receiving synkayvite® plus 250 mg. of ascorbic acid three times daily, 32 (10.32%) had postoperative bleeding and 3 (0.97%) required any intervention. A third series of 179 patients was given only ascorbic acid in addition to the acetylsalicylic gum, and in this group 13.96% had some postoperative bleeding but only 7.26% required intervention. From this study, Coombs concludes that the use of synkayvite® postoperatively exerts a beneficial effect in lowering the incidence of postoperative bleeding and that the use of ascorbic acid in conjunction with the vitamin K preparation has an even greater beneficial effect.

Preston,[25] in discussing postoperative tonsil bleeding, reviews the dynamics and physiology of blood clotting and hemostasis and reviews the causes of postoperative tonsillectomy hemorrhage. Included in his list are systemic disturbances such as hemophilia, leukemia, the purpuras, and hepatic disease, which may interfere with proper clot formation, as well as hypertension and sclerosis of the vessel walls, which may interfere in a mechanical way with hemostasis. Local factors such as recent infections and the resultant engorgement of the parts and chronic infections (Vincent's and syphilis) with their dissolving effect upon the clot or blood vessel

23. Jones, E. H.: The Prevention of Secondary Hemorrhage Following Tonsillectomy, South. M. J. **42**:124, 1949.

24. Coombs, A. J.: A Study of Delayed Bleeding Following Removal of Tonsils and Adenoids, Laryngoscope **60**:296, 1950.

25. Preston, H. G.: Postoperative Tonsil Bleeding: Studies of the Etiology, Prevention and Management, Laryngoscope **59**:251, 1949.

erosion are also mentioned. Trauma is recognized for its predisposition to secondary hemorrhage. In addition to reviewing the recent literature on the subject, Preston reports the reduction of postoperative bleeding from 5.2% of the patients in 1,423 operated on during the period 1939 to 1943, to 1.95% in 1,837 operated on during the period 1944 to 1947. This decreased incidence is attributed to the use of the Beck tonsillotome and snare for the remaining lower pole tissue and the administration of vitamin K, ascorbic acid, the sulfonamides, and penicillin when infection is anticipated or when the coagulation time is more than eight minutes.

Waldapfel [26] divides post-tonsillectomy hemorrhage into that which occurs a few hours after the operation and that which occurs several days later. Hemorrhage which occurs several days later does not often pose much of a problem, and the use of chemical cautery after the removal of the clot usually suffices. Hemorrhage which occurs a few hours after the operation may be much more troublesome. Pressure with a sponge may be enough for its control and if not, tying of the bleeding point with absorbable surgical suture is the next step. The early bleeders are divided into (*a*) those whose bleeding can be controlled with a tie and (*b*) those whose bleeding cannot. The cause for the latter may be "parenchymatous bleeding, an unruly patient, pharynx reflex, hemophiliac tendency, etc." When this is the case, other measures may have to be resorted to, such as treating the fossa with a sponge dipped in Mandl's solution (a solution consisting of iodine, potassium iodide, phenol, and glycerin), suturing the pillars together over a gauze tampon, or the use of a compressor hemostat. The comparative merits of these methods are discussed by Waldapfel, who also mentions that in order to fit the fossa better, tonsil sponges should be made elongate or oval instead of round.

RELATIONSHIP TO POLIOMYELITIS

Probably no aspect of tonsil and adenoid surgery has received as much consideration and publicity as the possible relation between the operation and the incidence of acute anterior poliomyelitis. The literature for the years 1949 and 1950 contains several articles relating to this subject, and they are either violently in favor of or violently against the possibility of a causal relationship between the two. Both camps may be nearer to agreement than either realizes, however, in that almost everyone agrees that any elective surgery should be delayed in the face of an epidemic of any kind.

Nau,[27] in reviewing the literature, finds that the reports and conclusions are conflicting but states that in general most reporters are in agreement that tonsillectomy, either remote or recent, does not predispose to poliomyelitis. Many have shown, however, that if it does develop in a person recently tonsillectomized, the chances of its being the severer bulbar type are greater. Nau also states that except in Texas and California, where the poliomyelitis season is longer, there is no danger at all in performing the operation from November to June as far as its causing a predisposition to poliomyelitis.

The widely publicized and highly controversial Cunning reports, sponsored by the American Laryngological, Rhinological and Otological Society in an attempt to

26. Waldapfel, R.: Control of Post-Tonsillectomy Hemorrhage, Am. Pract. **1**:1272, 1950.

27. Nau, C. H.: Poliomyelitis Following Tonsillectomy: A Review of the Literature, Arch. Pediat. **66**:49, 1949.

shed light upon the possible relation between tonsillectomy and poliomyelitis, continue to deny any statistical relation at all. In the report for 1948,[28] there was a total of 10,624 cases upon which data had been received. Of these cases, there had been tonsil surgery in 0.36% within a 30 day period prior to the onset of the disease. Of the total, 1,481 were bulbar in type, and in 1.7% there had been recent tonsillectomy. In contrast to these figures, it is pointed out that in the same group of cases, 0.3% had been preceded by surgery other than tonsillectomy. In the 1947 survey, 1.9% of the cases had been preceded by surgery other than tonsillectomy, and in the 1946 survey, 1.1% had been preceded by surgery other than tonsil surgery.

Likewise, in the report of the survey for 1949,[29] in which Cunning presents in tabular form the results of a by now four-year study including 36,678 cases of poliomyelitis and 96,379 cases of tonsillectomy, there is failure to see any causal relation between poliomyelitis and tonsillectomy. Cunning had not read any other reports from any other sources which offered any conclusive proof that tonsillectomy does predispose to bulbar poliomyelitis. However, warning is given against the performance of any elective surgery during an epidemic regardless of its nature.

Faber [30] takes issue with the conclusions reached by Cunning and states that should the evidence prove that no causal relation exists between poliomyelitis and tonsillectomy, then it would seem that tonsillectomy is a safe procedure to perform during poliomyelitis epidemics. He calls attention to the report of Anderson in 1945 [31] in which the incidence of poliomyelitis in recently tonsillectomized children was 2.6 times greater than in the general child population and that of bulbar and bulbospinal types was 16 times greater. Faber calls attention to the fact that in recent years the publicity given to this problem by the National Foundation for Infantile Paralysis has resulted in a great reduction in the numbers of this operation during times and at places at which poliomyelitis has been present. This has had a decided effect upon the statistics of the incidence of the disease in recently tonsillectomized children, and he expresses the hope that pediatricians will continue to urge against the removal of tonsils and adenoids while poliomyelitis is present in the community.

Wesselhoeft,[32] in discussing the problems of tonsillectomy and tracheotomy in relation to poliomyelitis, recalls that in the past there have been several widespread misconceptions about the epidemiology of this disease and considers tonsillectomy one of the misconceptions. This constitutes a reversal of his former opinion and results from a careful perusal of the facts over several years. He also states that in 30 yr. of observation he has seen no case of poliomyelitis in which he was convinced that tracheotomy was indicated. He advocates postural drainage and careful, skillful suction in the bulbar poliomyelitis. The use of atropine in such cases is spoken against because it renders the tracheobronchial secretions of a harder consistency to deal with rather than preventing their formation. Wesselhoeft suggests that the Minneapolis group may have headed an undue wave of enthusiasm in favor of

28. Cunning, D. S.: Poliomyelitis-Tonsillectomy Survey, 1948, Laryngoscope **59**:441, 1949.

29. Cunning, D. S.: Poliomyelitis-Tonsillectomy Survey, 1949, Laryngoscope **60**:615, 1950.

30. Faber, H. K.: Adenotonsillectomy and Poliomyelitis, editorial, Pediatrics **3**:255, 1943.

31. Anderson, J. A.: Poliomyelitis and Recent Tonsillectomy, J. Pediat. **27**:68, 1945.

32. Wesselhoeft, C.: The Problems of Tonsillectomy and Tracheotomy in Relation to Poliomyelitis, Laryngoscope **59**:726, 1949.

tracheotomy in bulbar poliomyelitis and that when it is done very early, as has been advocated, one can never assess its true value.

Anderson and others [33] have reported a comprehensive study of the 1946 outbreak of poliomyelitis in Minnesota. They calculated the number of children in the state from revised 1930 and 1940 census figures, then calculated the estimated number of tonsillectomies done by applying the figures from a sample of five Twin Cities hospitals to the state as a whole. Case studies were done on 2,709 patients with poliomyelitis and the attack rate in the two groups of children was determined. There were 21 cases of clinically recognizable poliomyelitis which occurred within one month after tonsillectomy, 19 being available for detailed study. There were 18 cases which occurred during the second and third months following tonsillectomy. Of those occurring within one month, 12 (63.2%) were bulbar, while of those whose onset was during the second and third months, four (22.2%) were bulbar. Anderson and others concluded that "the risk of developing poliomyelitis was at least three times as great among those undergoing tonsillectomy as among a comparable group not undergoing the operation, and the risk of bulbar infection was eleven times as great."

Treynor,[34] on the other hand, reported the outbreak in southwestern Iowa during 1948 to 1949, and in this epidemic involving 374 hospitalized patients, 45 of whom had bulbar poliomyelitis, he could demonstrate no connection between tonsillectomy and poliomyelitis, either bulbar or spinal. Attention is directed to several possibilities for the disagreement of his figures with those of others. He states that this epidemic might have been caused by an organism with no special affinity for the upper nervous system or by one spending its invasive period in the gastrointestinal tract and given no impetus to invasion by surgery. He also comments that had his report depended entirely upon hospital and office records, two of the only three cases following tonsillectomy would not have been found.

Dowe [35] reviews the literature on this subject and recalls that bulbar poliomyelitis is reputed to occur more frequently in recently tonsillectomized patients because of the trauma to the pharyngeal tissues which constitutes an entrance for the organisms. He summarizes that if one does accept the view that tonsillectomy increases the possibility of developing the disease during an epidemic, he must concede that the increased risk is very small. He grants that patients who do have poliomyelitis after tonsillectomy are more apt to have the bulbar type, this having been shown in the Toronto epidemic of 1937.

Dunn,[36] in reviewing this subject for the Oto-Rhino-Laryngological Society of New South Wales, makes the statement that the controversy has caused a division into physicians who advise against tonsillectomy during an epidemic and otolaryngologists who, "whilst remaining cautious, suggest that the physicians have insuffi-

33. Anderson, G. W.; Anderson, G.; Skaar, A. E., and Sandler, F.: The Risk of Poliomyelitis after Tonsillectomy, Ann. Otol. Rhin. & Laryng. **59**:602, 1950.

34. Treynor, J. V.: Tonsillectomy and Poliomyelitis—Southwestern Iowa, 1948-1949, J. Iowa M. Soc. **40**:400, 1950.

35. Dowe, J. B.: Poliomyelitis and Its Relation to Recent Tonsillectomy, M. J. Australia **2**:241, 1950.

36. Dunn, R. E.: Poliomyelitis and Tonsillectomy: A Review of the Literature for the Oto-Rhino-Laryngological Society of New South Wales, M. J. Australia **2**:243, 1950.

cient evidence to support this advice." He concludes his review with the following summarizing statements:

1. Although a few writers have claimed that the tonsillectomy-poliomyelitis sequence is coincidental, they do not suggest that the operation should still be performed when the number of cases has reached epidemic proportions.

2. Very few figures are quoted to illustrate the ratio of patients undergoing tonsillectomy with an uneventful recovery, to those which developed poliomyelitis during the epidemic season. The publicity given to the tonsillectomy-poliomyelitis sequence has so reduced the number of tonsillectomies performed during the epidemic season, that the figures, if obtainable, would not now be entirely representative. However, it would seem that, for every 2000 tonsillectomies performed during the epidemic period, one is followed by poliomyelitis.

3. The type of poliomyelitis following tonsillectomy is usually bulbar.

4. Numerous cases of bulbar poliomyelitis following tonsillectomy have been reported.

5. If the still undetermined risk of removing tonsils and adenoids during the poliomyelitis season is to be reduced by means other than postponing the operation, there is need for (*a*) a practical method of determining the presence, or absence, of the poliomyelitis virus in the prospective patient, and (*b*) a practical method of obtaining information concerning the incidence of poliomyelitis victims in the vicinity of the prospective tonsillectomy patient's home and school.

6. The risks involved by tonsillectomy during the epidemic season should be considered together with other numerous hazards of tonsillectomy and the urgency of the indications for performing the operation.

MISCELLANEOUS COMPLICATIONS

Various rarer complications of the operation for the removal of tonsils and adenoid tissue continue to be reported, such as a brain abscess which developed five days postoperatively, reported by Alexander and Reynolds.[37] This case is of interest because of its rarity as well as the fact that it occurred during the poliomyelitis season, though there was not an epidemic in the territory at the time (only one case in Washington, D. C.). At autopsy a diffuse frontal lobe abscess was revealed but no source of infection found. Alexander and Reynolds suggest that possibly some of the conditions diagnosed as poliomyelitis following tonsillectomy may have been other intracranial conditions complicating the surgery.

Zweighaft[38] reports a case of complete hemiplegia including the facial nerve on that side in a 5-yr.-old patient following tonsillectomy which was otherwise uneventful. There was no sensory loss, and the condition resolved itself completely in four weeks. Zweighaft reviews the literature on the subject and urges that tonsillectomy anesthesia not be lightly assigned and that oxygen be used to carry the ether vapors to the patient. He believes that the case he reports was due to a cerebral vascular accident.

Steele and Anderson[39] report their bronchoscopic findings in a group of patients with tonsillectomy done under general anesthesia, in an attempt to evaluate the risks of pulmonary complications. They emphasize that adenotonsillectomy is probably the most frequently carried out surgical procedure in this country, and that atelectasis and pulmonary abscess are not infrequent complications. They quote several authorities on the ease with which conditions are brought about at adenotonsillec-

37. Alexander, S. A., and Reynolds, R.: Abscess of the Brain Following Tonsillectomy and Adenoidectomy, Arch. Otolaryng. **50**:450 (Oct.) 1949.

38. Zweighaft, J. F. B.: Hemiplegia Following Tonsillectomy, Anesthesiology **10**:729, 1949.

39. Steele, C. H., and Anderson, J. R.: Tracheobronchial Aspiration Following Tonsillectomy with General Anesthesia, Arch. Otolaryng. **51**:699 (May) 1950.

tomy for the development of pulmonary complications. In a series of 129 patients operated on under general anesthesia and bronchoscoped at the termination of the procedure, 125, or 96.9%, were found to have measurable amounts of bloody secretions in the tracheobronchial tree. Steele and Anderson point out measures for the reduction of situations and conditions favoring pulmonary complications.

Ruddy [40] has employed a system of continuous pharyngeal suction to be used in addition to the head-extended position in tonsillectomy with local anesthesia in adults. After topical anesthesia of the throat, he inserts a 14 French catheter through each nostril into the oropharynx. The tip of each catheter has multiple perforations. He describes this technique as having the advantage of affording clearer view for the operator as well as diminishing the dangers of aspiration with resulting possible complications.

Williams [41] points out the rarity of acute septicemia following tonsillectomy and reports four cases in 30,000 adenotonsillectomies. Emphasis is laid on the difficulty of the diagnosis at the onset of symptoms, usually vomiting, perhaps diarrhea and collapse. He also points out the very interesting observation that this rare complication has been reported at least three times in pairs, each pair composed of two small children from the same family. He offers the speculation that acute streptococcic tonsillitis might have been just on the point of developing in each pair at the time of operation. If such were the case, it is difficult to see how such an occurrence could be avoided and, at the same time, why it does not occur more frequently.

An account is presented by Taylor [42] of a death after adenotonsillectomy in a 7-yr.-old Negro girl, apparently due to prolonged anoxia from mechanical obstruction of the airway by a postnasal pack. He advises the insistence upon adequate and continuous postoperative observation of patients, especially when a postnasal pack has been inserted. The airway must be kept free by whatever means are at hand, and when an accident does occur the speed in reestablishing the airway and instituting cardiac massage when necessary is vitally important. Recent thoughts regarding status thymicolymphaticus are mentioned, as well as other factors in the case other than the primary one of prolonged anoxia.

The question of the responsibility for sponges used in tonsillectomy is considered by Fisher,[43] who cites a case of death following the aspiration of an overlooked tonsil sponge. He calls attention to the ruling of the Supreme Court of Canada to the effect that the surgeon is completely responsible and liable if an accident occurs as the result of an overlooked sponge, since the presence of the sponge in the tracheobronchial tree in itself constitutes evidence of inadequate search.

ANATOMY AND PHYSIOLOGY

The widely held concept that the tonsils represent vestigial structures, along with the adenoid tissue, simply because they atrophy is now being replaced, according to Page,[44] by new interest and curiosity with regard to these lymphatic tissue masses.

40. Ruddy, L. W.: Continuous Pharyngeal Suction During Tonsillectomy Under Local Anesthesia, Laryngoscope **59**:790, 1949.

41. Williams, E. W.: Septicemia After Tonsil Operations, J. Laryng. & Otol. **63**:115, 1949.

42. Taylor, G. W.: Death Following Tonsillectomy, Arch. Otolaryng. **52**:642 (Oct.) 1950.

43. Fisher, T. L.: Responsibility for Sponges in Tonsillectomies, Canad. M. A. J. **63**:405, 1950.

44. Page, E. D.: The Anatomy and Physiology of the Tonsil, Med. Illust. **3**:106, 1949.

He points out some anatomical features of these structures, then recalls that in mammals the tonsil begins primarily as a tubular structure which later is provided with a variable amount of lymphoid tissue at its orifice. He states that it probably acts as a sentinel. Its development is from the ventral portion of the second pharyngeal pouch, and it ultimately constitutes a part of the ring of lymphoid tissue which makes clear by its location and structure its own function of guarding the alimentary tract.

Wright [45] introduces several novel ideas in his review of the evidence of tonsillar function. He states that the tonsils, along with the appendix and Peyer's patches and the remaining parts of the ring of tissue which bears Waldeyer's name, form a part of a generalized system of subepithelial lymphoid tissue whose function is not as yet too clear. This system constitutes a part of the lymphatic system as a whole, whose function is to aid the closed blood circulatory system in the maintenance of the life of the tissue cells. It is responsible for helping to maintain a suitable fluid environment for these cells and, in addition, provides a defense reaction zone against infection and injury as well as forming immune bodies and performing certain specialized intestinal functions (fat absorption). Logically, these subepithelial collections are found where infection and bacterial activity are most commonly found. Their locations would lead one to believe that they function as sentinels, the adenoid tissue for bacteria in the inspired air, the tonsils for foodstuff ingested, and Peyer's patches and the appendix for liquid intestinal contents. Many surgical man hours are devoted each year to the removal of these lymphoid sentinels, apparently without harmful effects upon the organism. The tonsils are known to be largest during the early years when immunity is developing, and several observers have noted that their removal results in hypertrophy of the remaining lymphoid structures. Wright believes that the tonsils "sample" the bacterial contents of the environment, so to speak, and introduce them into the lymphatic system in the proper amount and at the proper rate for the production of antibodies. He states that with modern travel facilities man has more and more opportunities for exposing himself to various environments and the function of the tonsil in "exposing" him to different bacterial groups has become less and less important. Thus the removal of tonsil tissue has less and less effect upon people. He summarizes

> This being so, we must be content to continue to remove, when necessary, such erring structures until either our environment shows a great diminution in bacterial content or we evolve, during the course of a few hundred generations, a structure more in keeping with the conditions then prevailing.

Meyer [46] states that the tonsil is a part of the lymphatic defense system against infection and as such protects the body and the blood stream against the spreading of dental, oral, and nasal infections. Thus he says that much tonsillitis is not a disease *sui generis* but is a defense reaction against some other infection and the tonsil, instead of being removed because of its protests against this other infection, should be "rewarded for its valor in contributing to a remedial effort." Along with a plea for discontinuation of indiscriminate removal of tonsils, he issues the statement that

45. Wright, A. J.: Tonsillar Function: Review of the Evidence, J. Laryng. & Otol. **64**:1, 1950.

46. Meyer, O.: The Eliminating Function of the Tonsils, Eye, Ear, Nose & Throat Month. **29**:140, 1950.

most tonsillectomies are incomplete and leave stumps of tissue which become chronically infected and play a vital role in continuing throat infections.

A new evaluation of lingual tonsils is presented by Elfman,[47] who reviews the anatomy, histology, and histopathology of this lymphoid tissue mass and decries the lack of interest that laryngologists show in it. He describes acute inflammation of the lingual tonsil as causing pain lower down than diseased faucial tonsils. There is a sharp discomfort on swallowing which the patient feels in the thyrohyoid area. The treatment of acute inflammations is systemic, as is the treatment of acute disease of the faucial tonsils, with antibacterial agents. The condition may become subacute and hang on for three or four weeks. When it becomes chronic, the patient is "throat conscious," and has a dull ache or a feeling of a lump in his throat when he swallows. The treatment of chronic inflammatory disease of the lingual tonsil is removal of the affected tissue. Small masses may be removed by electrocoagulation with a bipolar needle under local anesthesia or with the older galvanocautery, which is less desirable. Large masses of lingual tonsil may be dissected from the tongue from in front backward and snared free at the posterior end. An assistant must hold the tongue forward and a mirror in place, leaving the operator free to dissect. Elfman considers the Myles lingual tonsillotome to be inadequate and points out the definite anatomical distinction between the tonsil tissue and the underlying tongue, so that the dissection presents no anatomical difficulties. Many bizarre complaints in the throat region are attributed to disease conditions of the lingual tonsil.

In discussing the relation between the uvula and tonsillectomy, Froeschels[48] presents several theories of uvular function and describes six different types of uvular configuration. He warns against reducing the length of the uvula at tonsillectomy, since it always becomes shorter following the operation.

An unusual case of tonsillar cyst is described by Mason.[49] The cyst was known to have been small for several years before it enlarged and became pedunculated and produced symptoms by touching the base of the tongue. Excision of the cyst relieved all the symptoms. Upon section, the cyst was found to be lined with ciliated respiratory epithelium, and Mason advances several possible explanations as to the occurrence of respiratory epithelium in this location.

IRRADIATION THERAPY

The use of short distance, low voltage x-ray therapy for treating inflammatory conditions in the tonsils is advocated by Hultberg.[50] He reports 10 cases with favorable results following x-ray treatment of chronic infection and hypertrophy of tonsillar tissue. He uses an applicator intraorally and delivers 500 to 600 r three times at two to three day intervals, claiming that there is atrophy of the tonsils and complete regression of the inflammatory condition. On the basis of this study, Hultberg urges that this method be tried more extensively in the treatment of tonsil infections and not only in cases of some contraindication to the surgical removal of the tonsils.

47. Elfman, L. K.: Lingual Tonsils: A New Evaluation, Laryngoscope **59**:1016, 1949.

48. Froeschels, E.: Uvula and Tonsils, Arch. Otolaryng. **50**:216 (Aug.) 1949.

49. Mason, M.: An Unusual Case of Tonsillar Cyst, J. Laryng. & Otol. **64**:143, 1950.

50. Hultberg, S.: Short Distance Low Voltage Roentgen Therapy of Inflammatory Conditions in the Tonsils, Acta radiol. **32**:66, 1949.

Van Eycken [51] reaches an entirely different conclusion with regard to irradiation of tonsil tissue on the basis of the histological examination of a pair of tonsils which had received 166.8 mc.-hr. each (one radon seed in each tonsil daily for three days) 20 yr. before their removal. The patient had come in because of repeated attacks of sore throat, and examination had revealed large, chronically inflamed tonsils. Histological sections were described as showing mildly hyperkeratotic epithelium, moderate hyperplasia of the lymphoid elements, fibroplasia replacing much of the parenchyma, and generally thicker vessel walls than usual. The conclusion Van Eycken reaches is that surgical removal is the preferred treatment for chronic tonsil infections.

Cancer of the tonsil and its treatment by irradiation is considered in a comprehensive and detailed manner by Hulbert.[52] He notes that of all tonsillar malignant growths, 70 to 80% are epidermoid in origin, including the subgroups, and the remaining 15 to 20% are of the reticulosarcoma group. Rarer varieties such as salivary tumors, plasmacytomas and melanomas are worthy only of mention. The characteristics and irradiation therapy of each group are discussed. The epidermoid group of the malignant tumors of the tonsil has a tendency to spread early to surrounding structures and to metastasis early to the cervical nodes. The presenting complaint is often sore throat, though ear pain or blood-tinged sputum are not infrequently complained of. Since early spread to involve the fauces or palate is often seen, the primary site of the tumor may not be determined until irradiation therapy has caused it to recede toward its point of origin. In the treatment of the epidermoid group, the eradication dose falls little short of the maximum permissible dose, so precision in the therapy is essential. Hulbert advocates external irradiation with x-rays or radium units if the lesion has not extended beyond the anterior pillar. In lesions involving the anterior pillar itself, extending downward and forward, the use of two rows of radium implants is advocated, one medial to the jaw and one in the tongue. If external irradiation is employed, the adoption of cross-fire methods is necessary, using some system of beam direction to insure accurate reproduction of the planned field arrangement at each treatment session. In the reticulosarcoma group of malignant growths, the age incidence is lower and the incidence in men is not so great. The tonsil seldom is ulcerated and may present itself as a swollen, pale, reddish or bluish mass, expanded in all directions. Lymphatic spread is almost always present, with large elastic glands a frequent presenting complaint. Differential diagnostic points arise from the fact that the tonsil may be involved in generalized reticulosarcoma, Hodgkin's disease, and lymphatic leukemia. As these tumors respond to smaller doses of irradiation, best results are obtained by treatment of the whole region of spread. The dosage depends upon the technique chosen. If the treatment is restricted to a local area, 5,000 to 6,000 r may be applied over a five week period. If the treatment is regional, the dose is reduced to about 3,000 over the same period of time. Hulbert gives the following summary of the prognosis and results:

> The prognosis in both carcinoma and sarcoma depends on the extent of the disease when first seen. No form of treatment is known to salvage a satisfactory number of advanced cases.

51. Van Eycken, E. J.: The Tonsil After Radium Irradiation, Ann. Otol. Rhin. & Laryng. **59**:648, 1950.

52. Hulbert, H. E.: Cancer of the Tonsil and Its Treatment by Irradiation, Med. Illust. **3**:97, 1949.

Various statistical results have been published by different clinics and it is probably fair to say that an over-all five year rate (no evidence of disease) of 25 to 40 per cent can be obtained in carcinoma, the result being somewhat better in cases of regionally localized sarcoma. Figures however cannot express the prolonged palliation which can be achieved in a large number of advanced cases.

Interest continues in the use of irradiation for the treatment of lymphoid-tissue hypertrophy in the nasopharynx. Collins and others [53] report the results of their treatment of 41 cases of chronic nasal catarrh and chronic conductive deafness of Eustachian-tube origin with radon. They employed a glass capillary tube 3 cm. long, containing 20 mc. of radon, placed within a platinum tube whose walls were 0.5 mm. thick. This was mounted in a brass holder which was inserted into the nasopharynx through the nose and left in place for one hour. The beta rays were absorbed almost completely by the platinum, so the tube was considered to be an almost pure source of gamma rays. The calculated dose to the Eustachian cushion was 300 r in one hour and at 1 cm. in the tissues, 70 r. Collins and others list as the dangers of irradiation (1) interference with centers of ossification, (2) burns, with scarring and occlusion of the Eustachian orifice, (3) overdosage with a resulting large, patulous Eustachian-tube orifice, and (4) reduction in the activity of the cilia in the respiratory epithelium. They consider that with their technique these dangers are negligible. Most of their patients had already undergone adenotonsillectomy, and they advise that such be carried out, along with sinus investigation, before treatment is begun. They judge their results on an entirely symptomatic basis, saying that overtreatment would be the result of continuing until objective changes took place. Of tonsillectomized patients who were treated for nasal catarrh, 20 showed improvement or resolution of the disease and treatment failed in four. Of those treated for deafness, nine showed resolution or improvement and treatment failed in two. Of nontonsillectomized children treated for catarrh, five showed resolution or improvement, and treatment failed in none. Only one nontonsillectomized child was treated for deafness and it resolved. The number of applications varied from one (32 cases) to two (nine cases), and in no case were the symptoms made worse by the treatment.

The results of the use of nasopharyngeal irradiation for the improvement of hearing were reported by Guild [54] on the basis of an audiometric study done on a group of school children. Several years elapsed between the initial and the final hearing tests. A group of 259 children who had good hearing at the time of the first test and who had received no treatment between tests showed a slight average gain in hearing acuity for the low tones on the audiometer and a slight average loss for the high tones. A group of 95 children who had received nasopharyngeal irradiation because of defective hearing for the high tones, either on one or on both sides, showed the same slight average gain for the low tones that the normal group had shown plus a slight additional loss for the high tones. A third group of 12 children with a moderate hearing impairment for all tones showed a group-average improvement, but in nearly half of them there was no audiometric substantiation. The conclusion reached is that the previously held ideas concerning hearing improvement as the result of nasopharyngeal irradiation need revision.

53. Collins, E. G.; Thomson, I. S., and Swindell, G. E.: Radon Therapy of Nasopharyngeal Lymphoid Hypertrophy in Children, J. Laryng. & Otol. **63**:17, 1949.

54. Guild, S. R.: Nasopharyngeal Irradiation and Hearing Acuity: A Follow-Up Study of Children, Laryngoscope **60**:55, 1950.

In a general consideration of the value of irradiation of pharyngeal and nasopharyngeal lymphoid tissue, Lederer [55] recalls that irradiation therapy in this region is not a new concept but received new stimulus in 1939 by the work of Crowe and Baylor. He states that, in his opinion, the use of x-ray therapy with high voltage and sufficient filtration to give a half-value layer of 1 mm. of copper, applied through large ports so as to influence all the hyperplastic tissue of the pharynx, is a method worthy of consideration. He concludes that so far as is known at present, irradiation of the nasopharynx by standardized methods is practically without danger but should be used with restraint and only in those patients who do not present irreversible hearing defects.

Although he does not propose that more complete surgical removal of adenoid tissue could substitute for the methods of irradiation advocated by many when the lymphoid tissue is actually present in the Eustachian orifice or the tube itself, Furlong [56] enters a plea for more complete and thorough adenoidectomies, performed with at least as much skill and care as is expended on the removal of tonsils.

A complete review of the results of irradiation of nasopharyngeal lymphoid tissue is included by LeJeune and Lewis [57] in their summary of the literature on the pharynx for the year 1949 and should be referred to by physicians with further interest in the subject.

55. Lederer, F. L.: Evaluation of Irradiation of Pharyngeal and Nasopharyngeal Lymphoid Tissue, Ann. Otol. Rhin. & Laryng. **59**:102, 1950.

56. Furlong, T. F.: A Plea for Complete Adenoidectomy, J. Internat. Coll. Surgeons **13**:88, 1950.

57. LeJeune, F. E., and Lewis, M.: Review of the Available Literature of the Pharynx and Pharyngeal Surgery, Laryngoscope **60**:1013, 1950.

Abstracts from Current Literature

Ear

An Analysis of Hearing Loss Patterns in a Rural Illinois School System. E. Thayer Curry, Eye, Ear, Nose, & Throat Month. **29**:357 (July) 1950.

A report is given of a statistical analysis of hearing loss patterns made during the spring of 1949 in a school system in central Illinois. Tests were performed with pure-tone audiometry. For the screening technique a pure-frequency sweep test was utilized at 15 db. intensity at the seven frequencies 256, 512, 1024, 4096, 8192, and 11584. All persons who failed to pass this sweep test were given an individual audiometric test. Hearing loss was defined as a failure to respond to a tone as loud as 30 db. in either ear in any of the seven test frequencies.

Curry draws the following conclusions relative to the hearing characteristics of this group of 1,217 students in grades 5, 7, and 9: There is a statistical difference between incidence of hearing loss in boys and girls, as the occurrence in boys was 15.29% and in girls 10.10%. There was no statistical difference in the percentage of occurrence of hearing loss in the three grades tested. The tendency for loss of hearing to occur oftener in the right ear than in the left, noted consistently in the data, is not statistically significant. It is noted that a tendency exists for monaural hearing loss to occur oftener than binaural hearing loss and that this tendency is greater among boys than among girls.

Jennes, Waterbury, Conn.

Analysis of Hearing Loss Patterns in a Rural Illinois School System: II. Consideration on Specific Frequencies. E. Thayer Curry, Am. J. Dis. Child. **80**:254 (Aug.) 1950.

The second part of a comprehensive study is presented; the first was printed in the *Eye, Ear, Nose & Throat Month.* **29**:357-359 (July) 1950. The total school population of the community studied was determined to be 6,062. Certain questions were postulated, and the statistical answers are given in this paper. The tests were made in the spring by pure-frequency audiometry. Hearing loss was calculated as failure to respond to a tone of 30 db. At 256 cycles, both boys and girls showed a greater hearing loss than elsewhere in the scale, save that boys did worse at 4096 and 8912 cycles than girls. The fact is not explained. The incidence of monaural and binaural loss was not equally distributed in the test frequencies. This uneven distribution Curry also cannot explain, but he hopes that further investigation may clear the matter. Both boys and girls fail to respond to 30 db. in the right ear more frequently than in the left ear, but in the population studied the boys showed more deficiency in hearing than did the girls. The number of right ear hearing losses exceeded the left ear hearing losses in both groups. The findings in this meticulous study to a great extent defy ratiocination, but the facts seem to be well verified.

I. W. Voorhees, New York.

Hearing Reeducation—Its Applicability. W. L. Langsam, Eye, Ear, Nose & Throat Month. **29**:556 (Oct.) 1950.

Hearing reeducation is of value in hard of hearing patients. The therapy can be employed in persons requiring no hearing aids as well as in those requiring them. It consists of specially planned exercises taught to the patient and to the patient's relative or friend who is depended upon to be the assistant in the home exercises or treatments. These exercises are built up from the simple to the difficult, with encouragement and corroboration as very important features. A course of treatment may last any time from six weeks to six months depending on the nature of the difficulty and the loss in decibels.

The improvement of the patient by hearing reeducation does not show on the audiometer but can be noted by the reaction of the patient, by the observations of his circle of friends and relatives, and by his recognition of new sounds that have eluded him during the period of his disability. Also, improvement can easily be shown by the lessening of errors in word-survey lists.

JENNES, Waterbury, Conn.

REHABILITATION: THE OTOLARYNGOLOGIST AND AUDIOLOGY. FRANCIS L. LEDERER and RICHARD E. MARCUS, New York J. Med. **50**:2407 (Oct. 15) 1950.

Lederer and Marcus quote Canfield's definition of audiology which says that audiology is concerned with the propagation of sound, its conduction to the ear, its "fate" thereafter, and the psychological processes which interpret it in the brain. The inference is that many otologists are not well grounded in audiology in the broad sense and in its modern relation to allied sciences, particularly to speech as concerned with rehabilitation. Audiology is now a "basic science" and includes speech audiometry for interpretation of reception and discrimination levels, auditory reeducation, speech-reading ability, visual competence, group tests for screening of speech defects in schools, evaluation of hearing aids for the very young and very old, integration with acoustics, electronics, physiology, and instruction of parents, nurses, and others who live close to the child in his daily life. Since this is a very wide subject, the matter is being taken over by lay or nonmedical persons, who find in it a means of livelihood.

In the discussion, Dr. G. M. Trainor of Rochester, N. Y., recommended that otologists visit Veterans Administration centers to observe what is being done with this rehabilitation problem. He also stressed a better understanding of "fitting aids" to the deaf person so that the otologist can consult with and advise the patient of his needs. Dr. Alfred Doust of Syracuse, N. Y., said that since 1946 Syracuse has had a conservation of hearing center under the leadership of Dr. Gordon Hoople.

I. W. VOORHEES, New York.

TOPICAL MEDICATION IN OTOLOGY. JULIUS G. WALTNER and WESLEY R. WHITE, New York J. Med. **50**:2421 (Oct. 15) 1950.

There are four conditions which especially call for topical medication in otology: otitis externa (acute and chronic), chronic purulent otitis media, postoperative sterilization of the radical mastoid cavity, and persistent or recurrent purulent infection of an old radical mastoid wound. Pseudomonas aeruginosa and Escherichia coli have a way of subsiding, allowing the given area to heal, and then reappearing in an old infection where one may find a relatively sterile soil, especially in otitis externa. The authors have had good results with sulfamylon® (4-amino 2-methyl benzene sulfonamide hydrochloride). This drug is lethal for almost the entire bacterial family and is superior to streptomycin. It works promptly and is readily soluble in the secretions, thus increasing its efficiency. Moreover, it is the only drug which works well in acid mediums, especially in pus and blood. The commonly used sulfonamide compounds and penicillin are not effective because they seem, at times, to act as foreign bodies and are vitiated by Gram-negative organisms. This is especially true of penicillin. Half of all organisms cultured from chronic purulent otitis infections were Gram-negative. Ps. aeruginosa was a major factor in all relapses after healing seemed to be complete. When 5% sulfamylon® solution was administered immediately after radical mastoid operations through an indwelling catheter, in 20 consecutive cases the area epithelized and remained dry. The work was carried on in the Department of Otolaryngology, Columbia University College of Physicians and Surgeons.

VOORHEES, New York.

AN EXPERIMENTAL STUDY OF THE VIBRATION OF THE BONES OF THE HEAD AND CHEST DURING SUSTAINED VOWEL SOUNDS. JAMES M. MULLENDORE, Speech Monogr. **15**:163 (Sept.) 1949.

Eight vowel sounds were studied with sound-analysis equipment, and the following conclusions were reached:

1. Vibration of the bony framework of the body is the forced vibration resulting from the movements of the vocal folds.

2. All spectrums contained from nine to 24 measurable partials, with most of the energy concentrated in the fundamental and first overtone.

3. The spectrum of any given vowel obtained from the thyroid cartilage by contact microphone differs considerably from the spectrum of the same vowel obtained with the air-borne microphone. The differences are less total energy from bone-conducted sounds and less total energy in high partials.

4. The bone-vibration spectrums for a given vowel are similar to those obtained from the bony tissues of the head and chest.

5. The thoracic framework may possibly vibrate as a unit.

6. The spectrums from the nose and mastoid contact points contain partials of about 1000 cps which are from 5 to 15% stronger than comparable partials from the thorax.

7. The mass and density of the bone at any point, rather than the proximity to a resonance cavity, may determine to some extent the vibratory response.

8. The proximity of the contact point to the larynx is more important in determining the intensity than the wave composition.

9. The location of the microphone rather than the stimulus vowel determines the intensity of the sound recorded.

10. Variations in the intensity of the framework vibration from subject to subject may be expected without regard to the vowel used.

11. The rank of intensity tends to remain constant, with the greatest at the thyroid cartilage, the next at the head position, and that of the mastoid location less than the ribs.

12. The intensity level of bone vibration, while primarily dependent upon the distance of the location from the larynx, is also determined to some extent by the proximity of the point to a resonating cavity.

PALMER, Wichita, Kansas.

HEARING DEFECTS IN CHILDREN. LAVELL H. LEESON, Canad. M. A. J. **62**:167 (Feb.) 1950.

Leeson points out the necessity for early recognition and treatment of the deaf child. One who becomes deaf prior to 2 years of age will not be able to learn speech. One who becomes deaf after 2 years of age is amenable to treatment, and this fact should lead physicians to take advantage of all methods available, including surgery and radium. Training is highly important, both for the child and for the parents, and should be emphasized. The children should be kept in the home rather than institutionalized.

MCGUIGAN, Evanston, Ill.

SOME LITTLE KNOWN ASPECTS OF THE PHYSIOLOGY OF HEARING. G. COPPÉE, Acta oto.-rhino.-laryng. belg. **3**:227, 1949.

Coppée summarizes the recent conceptions of the mechanics of the middle and inner ear, cochlear microphonics, physiology of the cochlear nerve, and pathways, frequency and intensity discrimination, and audiogram analysis (he uses audiographic curves representing tonal intensity in volts instead of decibels). He cites the works of Tröger on acoustic impedance of the ear as an explanation for optimum perception of the middle frequencies (800 to 1600). Analysis of the masking effect (based upon the works of Davis on the refractory phase of the nerve fibers), localization of the sound source spatially, the phenomenon of recruitment as a sign of cochlear lesions, and finally the electrophonic effects of the ear (the reverse of the microphonics) are reported.

The electrophonic effect of the ear is the sound perception when a sinusoidal current or current from loud speaker is sent to the ear, provided the intensity reaches 3 or 4 volts and the frequency is within an audible zone. The author explains this effect as produced by the contractions of the middle ear muscles transforming the electric vibrations into mechanical ones, hence stimulating the organ and cells of Corti, the latter producing sound perception by building differences of electric potentials on each end of the cells which are transmitted to the cochlear nerve.

HERSON, Chicago.

Larynx

SYMPTOMS AND CLINICAL FORMS OF CANCER OF THE LARYNX. JUSTO M. ALONSO, Rev. Otorrinolaring. **9**:103 (Dec.) 1949.

Alonso classifies cancer of the larynx according to its site of involvement. 1. The principle symptom of cancer of the glottis is hoarseness lasting months or years, and in the late stages asphyxia may occur. 2. Difficulty in deglutition is a principle symptom of perilaryngeal cancer, and often pain radiating to the ears, halitosis, and cervical metastasis are common symptoms. Asphyxia is a late occurrence; however, hoarseness is not a common finding. 3. The early symptoms of cancer of the epiglottis and aryepiglottic folds are always negligible, except perhaps for a cervical adenopathy. However, later in the course of the disease earache, difficulty in swallowing, and hoarseness appear. When the lesion extends to the larynx, dyspnea may be caused by the edema. 4. The symptoms of cancer of the vestibule may be very slight. One of the principle ones may be a discomfort in the lateral region of the hyoid bone. Cervical metastasis and asphyxia are late symptoms. 5. Paroxysmal asphyxia may be the first symptom of subglottic cancer. Alterations of the voice are not common. In this type of cancer terminal asphyxia may occur even before a diagnosis can be made.

PERSKY, Philadelphia.

Nose

THE INCIDENCE OF CONGENITAL IMPATENCY OF THE NASOLACRIMAL DUCT. EDWIN L. KENDIG JR. and DUPONT GUERRY III, J. Pediat. **36**:212 (Feb.) 1950.

Congenital impatency of the nasolacrimal duct was found in 5.7% of 1,000 newborn infants. In most of these patients the condition cleared with local application of penicillin ophthalmic ointment and massage of the lacrimal sac. If patency has not been established by the age of 6 months, the duct should be probed.

MACDONALD, Pittsburgh.

EXTRANASAL TYPE OF NASAL GLIOMA. GEORGE V. MILLER and H. W. NEIDHARDT, J. Pediat. **36**:798 (June) 1950.

Miller and Neidhardt report an unusual case: a nasal glioma. The tumor was present at birth and was round, reddish, and moderately firm. It involved the right side of the bridge of the nose and extended to the inner canthus of the right eye. It measured 2 cm. in diameter. Removal was followed by uneventful recovery.

MACDONALD, Pittsburgh.

ALLERGY AND VASOMOTOR DISTURBANCES OF THE NASAL AND SINUSAL MUCOSA. R. MELCHIOR, Acta oto-rhino-laryng. belg. **4**:7, 1950.

The article is a 126 page report presented at the Belgian Otolaryngological Society, Congress of 1950. The first part deals, in five chapters, with history, experimental anaphylaxis, infectious allergy, nonspecific allergy, and traits peculiar to allergy in humans. The second part, composed of three chapters, describes vasomotor disturbances of nasosinusal mucosa, polyposis, noninfectious nasal allergy, and finally infectious nasosinusal allergy.

In the chapter on allergy in humans, Melchior develops in more detail a discussion of inherited and acquired allergic manifestations; he discusses the role of alkalosis, hepatic deficiency, and autonomic and endocrine imbalance, as well as the influence of psychological factors. Meteorologic influences, diet, vitamins, and superimposed infections are mentioned.

Recent works point to the important role of adrenal insufficiency in allergic reactions. Among the usual nasal manifestations, the neuralgias of the head (Sluder's neuralgia and histamine cephalalgia [Horton's cephalalgia]) appear related to allergic manifestations. Concerning treatment of polyposis, the radical exenteration of polypoid mucosa seems justified to Melchior only in the ethmoid sinuses; for other sinuses he advises only ventilation and drainage procedures associated with allergy control, calcium, vaccines, and x-ray and radium therapy.

Among the etiological agents, dusts, pollens, and inhalants are discussed in a well developed chapter. Melchior assumes that food has a very small role in the etiology of nasal allergy and reports only one in 70 allergic adults in whom the influence of food was traced. The same is true for

medicines. Nasal allergy in small children appears to be mostly due to infection, and pure allergy of the nose and sinuses is generally encountered after the age of 10 years. Among allergic tests used currently the pollen ophthalmic test, the nasal spray of pollen, the scratch and intradermal tests, the leucopenic index, and the food-elimination tests are described. Concerning desensitization, pollen immunization by preseasonal and coseasonal methods is described. The latter has become more popular recently due to the rapid desensitization in one week obtained with minimal doses, with the technique of Vaughan and administration by the intradermal route. The elimination of associated house dust and inhalant allergy is stressed. Among antihistaminics, preference is given in the following order: promethazine (phenergan®), prophenpyridamine (trimeton®), diphenhydramine (benadryl®) and tripelennamine (pyribenzamine®).

Nonspecific desensitization sometimes gives results when the specific therapy fails. The desensitization comprises autohemotherapy; heterohemotherapy (blood of the father or mother); autoserotherapy; milk or horse serum injections; spleen, placenta or pancreas extracts administered parenterally; injections of 5% peptone solution; vagotonin given orally; injections of 50% peptone solution intradermally; nonspecific vaccines; calcium gluconate or sodium thiosulfate (hyposulfite®) intravenously; x-ray treatment of the spleen; correction of blood alkalosis or acidosis; etc. Physical and mental rest are helpful. Correction of hormonal imbalance is indicated. Local treatment (chromium trioxide [chromic acid®], phenol injections, and zinc ionization [electrocautery]) over the turbinates is mentioned.

HERSON, Chicago.

CHRONIC MAXILLARY SINUSITIS. G. M. H. VEENEKLAAS, Helvet. paediat. acta **5**:76 (March) 1950.

Chronic maxillary sinusitis is a common affliction of childhood. Of 1,327 new patients who were examined in 1948, 80 (6%) showed an involvement of one or both sinuses. The condition may produce fundamentally different symptom complexes. In one group of cases it may lead to general complaints such as lassitude, irritability, failure at school, bad complexion, and subfebrile temperature. In another group of cases the complaints tend to simulate other otorhinolaryngological conditions, such as adenoid facies and otitis. In a third type of cases attention may be directed toward the lungs on account of a persistent nocturnal cough and adventitious bronchial sounds. Roentgenologic examination is indispensable for the diagnosis of the condition. Therapy consists in fresh air, administration of penicillin, and irrigations of the antrum, which give satisfactory results.

FROM THE AUTHOR'S SUMMARY.

Miscellaneous

PNEUMOTHORAX AND MEDIASTINAL EMPHYSEMA COMPLICATING NECK SURGERY. L. BOWDEN, and O. SCHWEIGER, Surg., Gyn. & Obst. **91**:81 (July) 1950.

Pneumothorax presents a serious and not uncommon hazard to surgery in the lower neck. Awareness of the possibility, either during operation or immediately afterward, is the keynote to prompt recognition. Respiratory distress with or without cyanosis, variations in blood pressure and pulse rate, subcutaneous emphysema, or lag in respiratory excursion should arouse suspicion and lead to aspiration of the pleural cavity or immediate roentgenography of the chest for the establishment of the diagnosis.

The authors feel that surgical injury to the pleural apex is an unusual cause of this complication. On occasion it is possible that the development of pulmonary interstitial emphysema (from a partially obstructed airway or from positive pressure anesthesia) may result in mediastinal emphysema and pneumothorax. On the basis of the series of cases presented, however, it would seem that a tension pneumomediastinum caused by exaggerated respiratory effort and a partially open superior thoracic inlet leads to rupture of the mediastinal pleura and pneumothorax in most instances.

Prompt and adequate treatment is mandatory. The use of water-sealed intercostal catheter drainage has been without complications and is favored over the method of repeated aspiration.

FRIEDBERG, Chicago.

EXPERIENCE IN DEPRESSED SKULL FRACTURES. YUTAKA TSUIKI, Jap. J. Otolaryng. **22**:281 (July) 1950.

Tsuiki says the optimum time and the choice of regimen for treatment of skull fractures, particularly the depressed type located in and about the tuberosities, is an open question. He also states that even textbooks on general surgery fail to give a clear account of the subject. For this reason various observations made on a patient with a lesion of this nature are recorded and presented here. A man, aged 39, received traumatic injury to the head which caused a depressed fracture of the skull on the left side. About one year after the injury symptoms of paresthesia developed in both extremities opposite to the side of the injury, gradually increasing in degree. These symptoms were relieved when bone from the depressed area was removed, but a cure was not established. Obviously then, removal of the affected bone alone at this late stage was not enough to cause relief of cerebral edema or consequent increasing cerebral pressure.

The question arises in this case whether or not the treatment had been instituted while still in the effective period. Onset of paresthesia, which is the result of progressive cerebral pressure, should be regarded as a condition approaching the final stage of chronic effects of cerebral trauma. It might be adequately considered that the object of treatment of cerebral trauma should be primarily to obviate just such a state of chronicity.

Lessons gained from the present case may be summarized as follows: In cases of skull fractures of the depressed type in the region of the tuberosities the patient, though presenting no signs of cerebral lesions at the time, should be placed under observation for a sufficient length of time. Proper surgical treatment should be instituted immediately when there are signs of increasing cerebral pressure by resection of the depressed area or other measures in the cranium to relieve pressure on cerebral tissues.

HARA, Los Angeles.

Society Transactions

CHICAGO LARYNGOLOGICAL AND OTOLOGICAL SOCIETY

Sherman L. Shapiro, M.D., *President*

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Nov. 6, 1950

Tracheotomy in Tetanus. Dr. Emanuel Hezon and Dr. Edwin Killian.

A historical résumé of cases of tetanus requiring tracheotomy is presented together with reports of six cases. The various theories of pathogenesis are presented, followed by a discussion of the pathology and pathological physiology. Treatment of tetanus as a respiratory problem is fully discussed.

Myxofibrosarcoma of the External Auditory Canal. Dr. Hans Von Leden.

A 13-year-old Negro was admitted to Cook County Hospital with a tumor of the right external auditory canal and a complaint of diminished hearing. The past history indicated that two surgical excisions of the tumor and a course of x-ray therapy had failed to destroy the neoplasm.

The patient presented a light brown mass protruding from the right external auditory canal, resembling a cauliflower in appearance. The neoplasm filled the canal completely and displaced the tragus and concha laterally. It was firmly attached to the anterior wall of the canal by a broad base. Hearing tests indicated a hearing loss of the conduction type on the involved side. Roentgenograms showed normal aeration of the mastoid portions of both temporal bones. A biopsy from the protruding superficial portion of the tumor indicated a hyperkeratotic papilloma with embedded epithelial cysts and submucous collections of lymphocytes.

The entire tumor and a surrounding strip of apparently normal skin were excised, and the defect was covered by a thin split-thickness skin graft. Microscopic examination of the excised tumor revealed large areas of fibromyxomatous tissue with the characteristic appearance of a well differentiated myxofibrosarcoma.

The postoperative course was uneventful; the external auditory canal resumed proportions, and hearing tests indicated restoration of the hearing to the normal level. The patient appeared free of any disease for a period of eight months. A recent examination, however, revealed recurrence of the tumor in the same area, with extension to the posterior wall of the external auditory canal.

Otogenous Intracranial Complications. Dr. John Elsen, Dr. Elmer A. Friedman, and Dr. Norman Leshin.

Four cases of intracranial complications from chronic ear infection are presented. Two cases of perisinus abscess and lateral sinus thrombophlebitis, in one of which there was fatal termination, one case of temporal lobe abscess, and one case of extradural abscess and purulent meningitis are reviewed, with comment on the handling of each case. The masking effects of sulfonamides and the antibiotics are discussed and demonstrated. In lateral sinus thrombosis and brain abscess the various methods of treatment are outlined. The use of penicillin intrathecally in cases of meningitis from ear infections is emphasized. Thorough surgical removal of the mastoid focus in infection and intracranial complication is as important today as before the advent of the sulfonamides and the antibiotics.

Some Newer Surgical Considerations in Atrophic Rhinitis: Report of Work in Progress. Dr. Maurice H. Cottle, Dr. Jack Allan Weiss, Dr. Edward F. Pottorff, and Dr. Emanuel Herzon.

Sherman L. Shapiro, M.D., *President, Presiding*
Lawrence J. Lawson, M.D., *Secretary-Treasurer*
Dec. 4, 1950

Experimental Studies of Negative Pressure Produced by Respiratory Cilia. DR. JOHN J. BALLENGER, Winnetka, Ill.

An attempt was made to develop a negative pressure by ciliary action in the excised tracheas of rabbits and in the frontal sinuses of dogs. In the first case an occluding diaphragm of mucus collected from other rabbits was inserted into the pulmonary end of the trachea and, as the mucus was moved upward, a negative pressure averaging approximately 5 mm. of water was measured.

In the latter part of the experiment the mucus collected from the other dogs was placed in such a position as to occlude the frontonasal duct. The mucus then was moved down the duct by ciliary action, and a negative pressure developed within the sinus. This negative pressure averaged 24 mm. of water in 12 experiments on eight dogs.

DISCUSSION

DR. ALFRED LEWY: The apparent differences in pressure measurements between the experiments of Dr. Ballenger and Dr. Hilding might be explained by the difference in humidity in the surrounding atmosphere. I do not think those slight differences would in any way vitiate the experiments.

DR. OLIVER E. VAN ALYEA: I wish to commend Dr. Ballenger for repeating this work of Hilding. Though it seems a simple investigative problem it is, nevertheless, full of value. Some years ago we apparently did not regard ciliary activity as highly important in either the upper or the lower respiratory system. Hilding has brought this to our attention in showing, among other things, the great strength of the ciliary mechanism. It seems important that it be thoroughly understood if we wish to progress in the therapy of conditions involving the respiratory tract.

Perhaps the upright position would explain the variation in the results of the two experiments. Naturally, the frontal ostium being located in the most dependent portion of the sinus, there is a great pull downward but quite a distance for the mucus to travel before the production of negative pressure. This undoubtedly accounts for the pain which occurs in the morning with frontal sinusitis, and it is brought about as the person assumes the erect position and the accumulated exudate starts on its downward passage through the ostium.

I hope that Dr. Ballenger will continue with this work and that he will enlighten us on any information gained on the activity of the ciliary mechanism.

DR. SAMUEL SALINGER: I think there is another factor that might explain the end results obtained by Dr. Ballenger as compared with those obtained by Hilding; namely, the relative size of the sinus. We have no information as to the size of the sinuses in the Hilding animals as compared to the Ballenger animals. Differences in the capacities of the sinuses may be a factor in the results obtained.

Another item might be the question of the nasofrontal duct. I do not think we need to lay too much stress on the fact that there is a difference in negative pressure which depends on the caliber of the nasofrontal duct. What impressed me was that a plug of mucus being carried by ciliary activity toward the ostium can produce negative pressure, which satisfies the claim that many laryngologists have held for years, that a vacuum may be produced. It was the etiology that was a matter of dispute.

DR. HANS VON LEDEN: I should like to commend Dr. Ballenger and to ask a few questions. First, has he observed any difference in the negative pressure depending upon the length of time the animal had been dead? Is there a rapid decrease in pressure in a period of hours or minutes after death? The second point, which Dr. Salinger mentioned, is, Is not the strength of the mucus sheet dependent upon the size of the lumen? I wonder if that explains the differences in the pressure measurements in the experimental animals of Dr. Hilding and Dr. Ballenger.

DR. JOHN J. BALLENGER: Postmortem examinations were made on these animals. In none of the frontal sinuses in the dogs were there any postmortem changes, such as grossly discernible thickened mucous membrane or blood. From that one might conclude tentatively that a negative pressure of 24 mm. of water was not sufficient to cause gross damage in the mucous membrane of the frontal sinus.

Dr. Lewy mentioned the humidity; that, in work with cilia, is the most important single thing to control. Dryness is a natural enemy of cilia. We are all familiar with Dr. Proetz's suggestion that the pathogenesis of the common cold may lie in dryness. A blast of inspired air constantly strikes one spot in the nasal mucous membrane so that it becomes dry and devoid of overlying mucus. The ciliary action in that area is then stopped, and one barrier to sepsis is removed. In these experiments I did the best I could to control humidity.

Dr. Salinger mentioned the size of the sinuses and the vacuum. We attempted to assume that the air had been absorbed and, having made that assumption, calculated the cubic centimeters and the rapidity with which air was absorbed. When these were compared with the surface of the lung it became apparent that if the first assumption was true, the sinus surface can absorb oxygen more quickly than the alveolar surface, which is an untenable situation. The great difference must be explained by removal of the mucus down the frontonasal duct without replacement of its increased vacuum by gas. Once the negative pressure had developed in the frontal sinus that negative pressure was maintained for as long as four hours without any particular change in its level. I did not let any experiment continue longer than four hours. Presumably, negative pressure would be maintained as long as the cilia did not completely remove the mucus from the nasal duct. The animal might be dead for two or three hours, and there would still be negative pressure.

There is a difference in the size of the lumen of the trachea of the rabbit and the hen, which may explain the differences between the results of our tracheal experiments and those in the literature. In one of Hilding's articles he reported obtaining negative pressures in only two of the three dogs. In the third animal, postmortem examination showed a very wide frontonasal duct which, he felt, explained the lack of negative pressure.

Carcinoma of the Esophagus. DR. CHARLES B. PUESTOW, Chicago.

In a period of four years, 80 patients with carcinoma of the esophagus were admitted to the Veterans Administration Hospital at Hines, Ill. There were only 37 whose conditions permitted operation. The majority of the patients had extreme weight loss and a long history of dysphagia and were in the terminal stage of the disease when first seen.

The essential history in all cases was one of anorexia, progressive dysphagia, substernal discomfort, and weight loss. Carcinoma of the esophagus should be suspected in any patient who reports an unusual subjective sensation on swallowing. This symptom demands careful roentgenologic examination and, if any irregularity or suspicious areas are seen, esophagoscopy should be performed. A biopsy should be taken of any areas of ulceration, inflammation, or new growth to establish the diagnosis.

In those patients whose conditions are operable, intensive efforts should be made to correct the marked nutritional deficit usually present before operation is attempted. Blood transfusions, fluids given by mouth or parenterally, and special diets to insure the maximum intake of proteins, vitamins, etc., should be administered and evaluation made of cardiac, respiratory, hepatic, and renal function. Other special studies are carried out if indicated.

The surgical technique employed in lesions of the lower, middle, and upper thirds of the esophagus is described and illustrated by means of lantern slides, and the importance of adequate postoperative supervision is stressed.

In summary, I called attention to the fact that resection of the esophagus with esophagogastrostomy affords some relief to a patient with an otherwise hopeless disease. The high mortality rate is chiefly due to the poor nutritional state of the patient which results from late diagnosis and delay in treatment. Early diagnosis can enable the operation to be performed with relative safety and can increase the possibility of a permanent cure or added longevity and comfort for a patient with more advanced lesions.

Unfortunately, in this series of 80 patients, only four were operated on sufficiently early for curative resection to be performed. In spite of the fact that all patients in the group were

seen late in the disease, with emaciation, marked weight loss, and advanced nutritional disturbances, the operative mortality for the first 30 days after esophagectomy and gastroesophageal anastomosis was only 33%. In those patients operated on sufficiently early for curative resection to be accomplished, no deaths occurred in the first postoperative month.

DISCUSSION

DR. WILLIAM E. ADAMS: Dr. Puestow's paper covers a subject in which I have had continued interest since we started work on it a number of years ago. His presentation has been so complete that my remarks will be limited to emphasizing some of his points.

The question of early diagnosis, as in all malignant tumors, is important in this disease. If the surgeons who care for these patients can stimulate early recognition of the carcinoma, as Dr. Puestow said, it will make a great difference in the percentage of patients cured.

I should like to show a few slides to bring out some of these points. The first is a microscopic section through the entire length of a so-called scirrhous tumor contrasted with the medullary type in which the mucosa tends to overlap the tumor. If the biopsy includes only the mucous membrane it will show nothing significant; a deeper bite will show the tumor. These tumors spread through the entire thickness of the wall of the esophagus. That means we have to remove as much of the surrounding tissue as possible and, as Dr. Puestow said, enough of the organ in each direction to reach beyond the limits of the tumor. I find more and more that the lesion should be removed above the arch of the aorta instead of below.

The next slides have to do with roentgenologic diagnosis. Most roentgenologists would say this one represents a case of achalasia. The patient actually had treatment for achalasia for a year and a half until dilatations gave no relief. On exploration she was found to have an inoperable carcinoma involving the diaphragm and retroperitoneal structures. Operation was performed to sidetrack the lesion, and she immediately gained weight and lived for nearly two years. She died of the carcinoma.

Another condition of which we hear relatively little is congenitally short esophagus. These lesions produce gradual stenosis just above the cardiac end of the stomach. Endoscopic examination may indicate a benign condition of the mucosa. At the time an exploratory operation was performed on a patient, in 1947, the tissue appeared to be pliable and there was nothing to suggest carcinoma. A sidetracking operation was done to relieve the symptoms. About two years later the patient began to have stomach trouble and died of hemorrhage from a perforating ulcer. At autopsy an adenocarcinoma was found in the region of the gastroesophageal junction. We have had three patients in whom carcinoma developed at this point in the presence of a congenitally short esophagus. If this possibility is kept in mind, diagnosis is possible in most of these cases.

Lesions of the middle third of the esophagus are notorious for giving poor operative results; so much so that some institutions will not accept patients with this type of lesion for operation. This slide shows a large tumor which extended so high that it was necessary to do an anastomosis above the arch. It was a very fungating tumor, the only one of its kind we have encountered. It was a papillary lesion of fairly low-grade malignancy. Every once in a while such a tumor is found, and whether located in the middle third of the esophagus or elsewhere it is amenable to treatment. The patient has been four years without evidence of recurrence.

For patients who have inoperable lesions, we have felt it worth while to relieve the symptoms by this sidetracking operation. We have done it in 12 patients, and, although they did not survive for long, immediately following operation they were relieved of obstructive symptoms and were able to take food without a gastrostomy tube. In most cases the fundus can be brought up and a lateral anastomosis made. The operative risk is minimal.

I agree with Dr. Puestow that the value of antibiotics has been overemphasized in this field of surgery. I also agree that preoperative and postoperative care of these patients is of utmost importance. In our experience, if good surgical principles are followed, the main cause of operative deaths is a cardiovascular lesion, and it is our feeling that with the use of anticoagulants this danger will be less as time goes on.

Dr. Graham once said that the future outlook for patients with bronchogenic carcinoma depended largely on the ability of physicians who are dealing with them to continue to keep up the

patients' hope; if they lost hope the cause was lost. I am sure this is also true in carcinoma of the esophagus and cardia. We know these patients can live as long as 13 years after resection, because that is the length of time the first patient lived upon whom Dr. Phemister and I operated in February, 1938. We must continue working with physicians as well as the laity in order to achieve an early diagnosis.

DR. PAUL H. HOLINGER: Certainly Dr. Puestow has brought before us a timely subject. We all recognize the surgical aspects of this disease, yet there is sometimes a lag of a year or more between the time the patient first complains of symptoms and the time endoscopic examination is made and often a second lag between the time of histological diagnosis and surgical treatment. Frequently the endoscopist advises the patient to have surgical treatment, while the surgeon advises against it on the ground that the lesion is inoperable. There is also the problem of the patient who is relieved of pain by endoscopic dilatation and therefore refuses surgery, as well as the physician who advises against surgery only to have his patient demand it six months later. Thus we have the problem of convincing the physician as well as the patient.

From the standpoint of the endoscopist, I want to compliment Dr. Puestow on stressing the preponderance of acccidents in removing tissue for biopsy and the danger of an occasional perforation of the esophagus. Physicians who have had that happen know that it is a catastrophe. Yet we know carcinoma of the esophagus may be overlooked if we hesitate to take a deep bite of tissue because of the hazard of perforation. If we accept the possibility of perforation as one of the hazards of attempting to obtain a diagnosis, we may arrive at the stage of referring patients at an earlier time for surgical procedures. If the condition of the patient is satisfactory, we may make a more radical attempt to arrive at a diagnosis rather than adopt a policy of watchful waiting.

At times there are differing viewpoints between the endoscopist and the surgeon, but on one point we are agreed; that is, that surgical therapy as demonstrated by Dr. Puestow is the only therapy upon which we can rely to offer the patient not only comparative relief but also possible cure of his disease.

DR. STANTON FRIEDBERG: We have been impressed with the diagnostic difficulties encountered in some patients with esophageal lesions. It has been my good fortune to work with Dr. Puestow in the series he presented, and I would like to stress, as did Dr. Adams, the confusion which may arise from roentgenologic and endoscopic examination. There is a condition which is receiving increased consideration, namely, esophageal ulcers and the strictures which follow their healing. The roentgenographic appearance of some of these lesions can be misleading. There may also be localized ulcers associated with diaphragmatic esophageal hernias. The esophagitis which often occurs with diaphragmatic hernia may mislead one into a tentative diagnosis of malignant growth. This necessitates taking adequate and possibly repeated biopsies. Should these measures not be sufficiently conclusive, exploratory operation is indicated. Achalasia is sometimes difficult to distinguish roentgenographically from carcinoma of the esophagus.

[Slide] The patient presented a typical roentgenographic picture of stricture of the esophagus. The lesion had been treated accordingly. On endoscopic examination a biopsy was taken which proved to contain carcinoma. When this lesion was resected by Dr. Dorsey it was not more than 1 cm. in diameter, yet the patient had generalized metastases. He lived for about 18 months.

[Slide] This lesion of the lower esophagus was thought to be a neoplasm. A biopsy specimen revealed a crater formation of an ulcer of the esophagus with infiltration in the submucosa. It was decided from the roentgenographic and endoscopic appearance that the lesion should be resected. It proved, however, to be a simple peptic ulcer.

[Slide] This shows a rather extensive lesion of the esophagus which, after repeated examinations, we concluded to be a stricture resulting from peptic ulcer. One might speculate on the thoracic position of the stomach. We did not think that the patient originally had a hiatal hernia but believed that extensive scar tissue had pulled the stomach upward through the diaphragmatic hiatus.

[Slide] This shows the gastric rugae high in the thoracic cage in a patient with congenital short esophagus. Endoscopic examination and a biopsy specimen of this area revealed an early gastric carcinoma.

[Slide] This is a roentgenogram of a patient who was thought to have achalasia. The filling defect in the lower esophagus aroused suspicion of malignant growth. However, repeated endoscopic examinations and the response to dilatation led us to conclude that this was truly an achalasia and not a carcinoma. Biopsies repeatedly showed nothing significant, and the patient has responded to dilatation therapy.

[Slide] The patient had a hiatus hernia with a stricture but with so much ulceration and infiltration that we suspected carcinoma. It did not prove to be so.

Whenever there is doubt it is only logical to stress the importance of exploring the lesion surgically before too much time is lost. At surgery it is surprising how much more extensive the lesion is than one would assume from roentgenologic or endoscopic examination. We might mention a series of patients who had undergone vagotomy for peptic ulcer at the Hines Veterans Administration Hospital. In about 23% of the patients there was a complaint of dysphagia, usually without demonstrable evidence of organic trouble. Following resection of esophageal carcinoma, the patients we observed were much more comfortable but a sizable portion still complained of difficulty in swallowing. Why, we do not know. Dr. Puestow and I have discussed this many times and have decided that we have a great deal to learn about the physiology of the esophagus. Some of the patients who have had resection of the esophagus are unable to gain weight even though physically they have been rehabilitated and are feeling much better.

In conclusion, we might mention the role of the endoscopist in the care of the occasional narrowings which develop at the site of anastomosis following esophageal surgery. The immediate postoperative care of these patients requires thorough and perhaps repeated tracheobronchial aspiration for prevention of pulmonary complications.

DR. ROBERT LEWY: In covering the diagnostic and differential diagnostic problems involved, we have dwelt upon organic disease. For probably very good reasons, functional disease is not discussed. In my own practice, both public and private, I have seen a high incidence of the condition known as globus hystericus, to the degree that I felt obliged to take roentgenograms. The symptoms in many patients with globus hystericus may be similar to ulcer symptoms and to carcinoma or stricture of the esophagus. It is rather a problem to know when one is justified in roentgenologic examination and esophagoscopy in these patients.

DR. THOMAS GALLOWAY: We should have a screening process to discover early carcinoma of the esophagus. At Cook County Hospital we tried using a large capsule with barium to pick up early obstruction, with no particular success, but the method has possibilities.

The young men here probably never heard of the Souttar tube made of coiled German wire inserted through the malignant stricture, which enabled the patient to live three or four months longer, but he did not have a happy life with it. Carcinoma is one of the greatest tragedies in medicine. Early surgery, compared to Dr. Puestow's demonstration, was crude. I described more than 20 years ago an operation on cancer of the cervical esophagus. The esophagus was immobilized, and a plug of gauze was put behind it, isolating the tumor. After seven days further manipulation carried little danger. The esophagus was cut above and below the tumor, and the cardiac end was brought out below and the esophageal end was tied over a tube brought up through the wound. One patient on whom we did this operation lived three months and died of recurrent carcinoma of the larynx. It has been shown in the dog that reepithelization will take place over a defect of 4 to 6 cm. Dr. Lennon and I worked out this operation on some 20 dogs. We passed a tube through the esophagus, inverted its upper end over a knot, mobilized the esophagus, and then pulled it through a gastrostomy wound, ligating at the cardia. We passed a stripper like a large vein stripper along the esophagus, and, surprisingly, we could pass it down to the cardia and, in the dog, encountered no bleeding we could not control with diathermy with the long esophageal electrode. We had no dog die of hemorrhage, and in the dog the operation did work. I have never heard of anyone trying it on a human being.

Dr. Charles B. Puestow: A review of our patients upon whom esophageal resection has been performed for lesions not involving the stomach discloses a mortality of 16% during the first two postoperative weeks. The death rate during hospitalization of these patients is higher, because many patients in Veterans Administration hospitals have no place to go and, if they are debilitated, often remain in the hospital for many months until they finally die of their disease. The mortality rate for resections involving the lower esophagus and upper stomach has been only 5.5% during the first two postoperative weeks.

Much has been written about stenosis or obstruction at the site of gastroesophageal anastomosis. We have seldom encountered this difficulty. As mentioned by Dr. Friedberg, some patients have difficulty swallowing, although endoscopic examination reveals an adequate lumen at the site of anastomosis. Evidently some physiological disturbance produces the dysphagia.

Lesions of the middle third of the esophagus which lie behind and apparently invade the posterior wall of the arch of the aorta present a difficult problem. In attempting to free such lesions, we have occasionally perforated the tumor and entered the esophagus. When this occurs it is necessary to complete the resection although it is impossible to remove the entire tumor from the aorta. Many of these patients survive for months or longer and are comfortable and able to swallow food and improve their nutritional state. When they eventually die of their malignant growth, the terminal state usually is nonpainful. We have operated upon a number of patients whose diagnostic studies suggested an extensive carcinoma of the lower end of the esophagus but who, at the time of operation, were found to have a benign stricture. These have had a resection or a plastic procedure, after which they have led comparatively normal existences.

I enjoyed Dr. Adams' discussion. He and Dr. Phemister deserve a great deal of credit for the many contributions they have made to surgery of the esophagus and of the proximal portion of the stomach. They have been pioneers in this field and have added much to our knowledge.

Dr. Holinger indicated that we do disagree, but I do not think it is serious; I certainly know that his attitude is similar to ours and that his ability is unsurpassed.

Dr. Friedberg has brought out some most interesting points. I think we have a great deal to learn about the physiology of the esophagus, the relationship of vagotomy to it, and also the etiology of esophageal ulcers. We are just beginning to become interested in this organ, and I am sure in the next 10 years much progress will be made.

I do not know whether I shall try the operation mentioned by Dr. Galloway, but I admire the courage he had in trying that procedure when surgery of the esophagus was at such an early stage and presented dangers of mediastinitis and infection deep in the neck.

I want to thank the Society for giving me the privilege of appearing here, to thank the discussers, and to give due credit to my associates. Dr. Friedberg as well as my other associates have been most cooperative in this field of surgery at the Hines Veterans Administration Hospital. I hope in the future we shall have far better statistics to report.

Sherman L. Shapiro, M.D., *President*

Lawrence J. Lawson, M.D., *Secretary-Treasurer*

Feb. 5, 1951

Deafness Due to Mumps: Rehabilitation. Dr. Arthur J. Coombs.

A case of deafness in a 36-year-old woman due to mumps, which was bilateral at the onset but in which there was partial recovery on the left side, is reported. This side had been previously affected to a moderate degree by a middle ear infection of long standing. In the absence of any previous record of the degree of impairment, it is assumed that recovery was complete to the level of the preexisting hearing loss in this ear. The right ear, which had always been normal, showed practically total loss, which was permanent. There was no vertigo, and the vestibular function in the right ear was greatly diminished but was normal in the left.

By means of a hearing aid and a telephone amplifier, the patient underwent complete rehabilitation in her position as a private secretary. The hearing aid is suspended high on the right side of her chest so that the telephone may be held conveniently between the mouth and the microphone of the aid. Photographs show the ease with which this is done. She also studied lip-

reading as a further step in rehabilitation. It is suggested that many cases of unilateral deafness of unknown etiology in children might be due to mumps.

In the discussion of rehabilitation mention is made of the following points: 1. Subtotal deafness due to mumps is not an insuperable handicap. 2. Psychotherapy should be directed to the patient, if need be, to create a desire to overcome the handicap. 3. Close cooperation between a deaf person and his business associates should be effected whenever possible. 4. Rehabilitation by means of a properly fitted hearing aid, by the study of lipreading, and by the use of a telephone amplifier will restore many persons to their normal fields of activity.

DISCUSSION

DR. FRANCIS L. LEDERER: One is perhaps repaid for his efforts when one hears a physician—no less an otologist—describe what should be considered a very unrewarding part that he has played in the life of a hard of hearing patient. On the other hand, Dr. Coombs has underestimated his role. Undoubtedly he was rewarded by the response of this patient, who had a background of stability and who was able to take a crisis in her life in her stride. We should not forget that a patient who is deprived of a special sense reacts as he or she would when deprived of anything in earliest childhood. Perhaps Dr. Coombs was favored in having a patient with a good background; however, the employer too realized her importance as an employee, and he too has discovered the rewards of medical therapy (audiology) in dealing with deafness, in which the otologist is playing a more and more important part in the rehabilitation of the deaf and hard of hearing patient.

Dr. Lindsay reported 16 cases of unilateral deafness, and, when one thinks of statistics, that is rather a small incidence in the number of cases of mumps deafness that Dr. Coombs has reported from the literature. Many people go through life with unilateral deafness without realizing it until something brings it to their notice, so I believe that the statistics are not completely valid. One would say that many cases of so-called unilateral deafness may be due to mumps encephalitis, because so many people who have had mumps are not aware of it. The role of rehabilitation in bilateral hearing loss is, as Dr. Coombs has emphasized, vital to the patient.

DR. ALFRED LEWY: One of my patients, an ex-nurse, has discovered that she can use her hearing aid by laying the microphone on the telephone; this method avoids the rubbing noises. Several other patients have complained that they could not use the microphone through their clothing. They still have rubbing noises because their hands are not perfectly still. A number of these patients are as deaf as those reported by Dr. Coombs, and perhaps he has some suggestions to offer.

DR. ROBERT HENNER: I would like to commend Dr. Coombs on this splendid paper. He called attention to the fact that there are two phases of mumps during which ear symptoms are present. In my experience the early symptoms usually originate from catarrhal otitis and in the second phase are associated with nerve deafness and labyrinthitis. I have seen only one patient who had deafness and labyrinthitis. This patient had spontaneous nystagmus at the height of the disease, which made it improbable that the cause of deafness would be overlooked.

DR. JOHN R. LINDSAY: At one of our national meetings a few years ago the statement was made by the head of a large infectious diseases institution to the effect that he had never known deafness to result from mumps. That statement we know could only be explained on the basis that an adequate examination for unilateral deafness had not been made. Among the employees of our own institution we have observed three in whom unilateral deafness developed from mumps in a period of a few years. About three years ago I observed two students in the same class in college with unilateral deafness from mumps. I would agree with Dr. Lederer that it is a common complication. In my experience very few of these persons have had more than a day or two of dizziness at the onset. All have had very good function of the vestibular mechanism in the affected ear. In the older textbooks there are persons described with vestibular function diminished or lost, but I have not seen this. In my experience all have maintained good vestibular function but have had profound deafness for air and bone conduction.

DR. ARTHUR J. COOMBS: Dr. Lederer emphasized the point of teamwork between this young lady's employer and herself. I think the physician can play an important role here. Dr. George

Coleman happened to know the employer and brought a great deal of influence to bear in getting his cooperation and in giving the patient all the time necessary to become adjusted.

She was not bothered by rubbing noises. There was no vertigo, but she had definite diminution of vestibular function. As Dr. Lindsay emphasized, cases of unilateral deafness in undetected mumps is commoner than we think.

I found nothing new which would help regarding microbiology. It was always termed a virus type of infection.

Bronchoscopic Aspects of Fibrocystic Disease of the Pancreas. Dr. Paul H. Holinger, Dr. George C. Anison, and Dr. Kenneth C. Johnston.

Fibrocystic disease of the pancreas has been recognized as a clinical entity for only the past 11 years. It is of great importance to the bronchologist because the associated bronchopulmonary suppuration is usually the cause of death. The condition is caused by a congenital anomaly of the pancreas and other glandular structures, such as the bronchial and intestinal mucous glands, that results in an absence of fat digestion and absorption and, consequently, an avitaminosis of the fat-soluble vitamins.

Fibrocystic disease of the pancreas is characterized by failure of the infant to gain weight, general debility, steatorrhea with large, foul stools, and an extensive bronchopulmonary suppuration. Diagnosis is established by absence of trypsin in the stools, a flat vitamin A curve in the blood, and absence of pancreatic enzymes in the duodenal secretions of infants who show the clinical picture described above of marked debility, steatorrhea, and absence of subcutaneous fat.

During the past 10 years, 74 infants have been seen at the Research and Educational Hospitals and the Children's Memorial Hospital who have had fibrocystic disease of the pancreas. Of these, 32 required bronchoscopic aspiration to relieve them of their obstructing secretions; many had been admitted originally under the diagnosis of bronchopneumonia, atelectasis, or bronchiectasis, and the final diagnosis was established only after admission and study.

The tracheobronchial tree of these infants showed severely inflamed tracheal and bronchial mucosa with the lumens filled with thick viscid mucopus. Bacteriological examination of this material showed a pure growth of staphylococci, but other organisms were frequently found as well.

Therapy from a bronchoscopic standpoint consisted of efforts to promote endobronchial drainage through steam inhalations, postural drainage, and bronchoscopic aspiration. Chemotherapy was administered by aerosol and injection. Aureomycin given orally was found particularly beneficial. Dietary management consisted of the administration of approximately twice the usual caloric requirements of the patient's age and weight. A high protein, low fat, and low carbohydrate diet has been suggested, but a regular, unrestricted diet is now generally given. Certainly high doses of vitamins A, C, and D are indicated, together with liver extract. Pediatricians suggest that pancreatic granules be added to the diet, but since they decrease the appetite this procedure has been questioned. Recently cortisone has been administered because of its action as a carbohydrate metabolizer.

The prognosis in cases of fibrocystic disease of the pancreas is generally not favorable. The frequent recurrences of the bronchial infection are generally responsible for terminal bronchopneumonia. However, with active treatment of the bronchopulmonary suppuration many infants improve, and therefore repeated bronchoscopic aspiration is an important factor in prolonging the lives of these infants.

DISCUSSION

Dr. Paul H. Holinger: The etiology of this condition is completely unknown. All measures so far are completely palliative and actually have no effect on the course of the disease. The pulmonary disease runs concurrently with the pancreatic disease and is not a part of the pancreatic disease.

The prognosis is usually poor. Some children have lived for 5 or 6 years and a few 8 to 10 years. Usually such children have been treated shortly after the disease was recognized. While the actual etiology is unknown, there is a familial tendency, with infants dying one after another to the point where the mother is advised to have no more children. This tendency is definitely recognized, and the family therefore should be warned.

Planes of Surgical Dissection of the Neck. Dr. Maurice F. Snitman and Dr. Burton J. Soboroff.

Surgical dissection of the neck must necessarily be based on an intimate knowledge of anatomy. There are so many varied descriptions of the structure of the neck that it is sometimes difficult to interpret them. This is particularly true with regard to the fascial layers.

The cervical fascia consists of two chief layers, superficial and deep. The superficial fascia consists of fatty tissue and includes the platysma muscle within it. The deep cervical fascia is made up of an outer, or superficial, layer; a middle, or omohyoid, layer, and a deep layer. Descriptions of the outer fascial layer, particularly in relation to the parotid, are especially variable; those of the middle layer of the deep fascia are even more so. The deep layer of deep cervical fascia is generally described as the prevertebral layer. It lies immediately over the bodies of the cervical vertebras and prevertebral muscles and extends laterally to the transverse processes of the cervical vertebras.

Wintraub, in 1941, presented a description of a "new anatomic and functional systematization of the connective tissues of the neck." He considered the connective tissues in three major classes rather than individual, minutely subdivided fascial sections. These classes included (1) nerve vessel supporting connective tissue which consisted of nerve vessel bundles about main trunks and nerve vessel sheets about branches; (2) periorgan connective tissue, which included the condensation of the loose areolar tissue about individual organs in the neck, and (3) areolar tissue spaces, made up of loose areolar "packing" tissue filling the spaces between the muscles, vessels, and organs in the neck.

Dissection of the neck in the fresh cadaver and in the living patient reveals this to be the arrangement of the connective tissues of the neck.

These points were demonstrated with slides and color photographs of anatomic dissections.

DISCUSSION

Dr. Maurice F. Snitman: An excellent example of a misconception of fascial structure is provided by the so-called fascial capsule of the submaxillary salivary gland. After elevation and retraction of the skin and platysma flap over the submaxillary triangle, the loose tissue thus exposed is placed under tension because of elevation of the mandible. This collapsed and stretched loose areolar tissue gives the appearance of a distinct fascial layer. In reality it is an artificial structure, as its true loose areolar structure can be demonstrated by relaxation of the fascia and teasing it with tissue forceps.

This anatomic interpretation holds true for most of the hitherto accepted fascial layers of the neck.

Tracheotomy in Barbiturate Poisoning. Dr. Robert B. Lewy and Dr. J. W. Sibbitt.

The basic therapy of patients suffering from acute barbiturate poisoning is essentially the responsibility of the specialist in internal medicine. It is, however, essential that the otolaryngologist and anesthetist play a part in maintaining an adequate airway in these deeply comatose patients. The physiopathological condition in barbiturate poisoning is a basic respiratory obstruction, regardless of the type. In any simple obstruction of the trachea there first occurs reduction in ventilation capacity of the lungs. This decrease involves hypoventilation which, as it becomes more severe, results in specific chemical changes in the blood: (*a*) retention of carbon dioxide (hypercapnia), (*b*) fall in oxygen saturation of arterial blood (anoxemia), and (*c*) fall in the blood pH (acidemia) produced by the above two conditions. These three factors constitute the phenomenon asphyxia. In early obstruction there is a strong respiratory stimulus. In longer obstruction, a critical point is reached at which these blood changes cease to act as a stimulus and the breathing effort weakens. This causes an increased asphyxia which, in turn, actually inhibits breathing, thus setting up a vicious and progressive cycle. Death in these cases is usually due to respiratory failure.

Treatment is directed toward a maintenance of adequate respiratory exchange and blood pressure levels by means of oxygen, analeptics, convulsants such as picrotoxin and pentylenetetrazole (metrazol®), and fluids given intravenously or plasma with ephedrine. The laryngologist and anesthesiologist should be called upon to aid in maintaining oxygenation and an adequate airway. Simple suction in the hypopharynx plus postural drainage may be adequate to remove

secretions which pool in the hypopharynx and the tracheobronchial tree. If depression is prolonged, further procedures may be required. Bronchoscopy may be necessary; an endotracheal tube may be inserted. If cough and gag reflexes have not returned in 8 to 12 hours, tracheotomy should be done. If the endotracheal tube is allowed to remain in place for a prolonged period of time, serious damage to the larynx may occur.

Three illustrative cases are presented in detail, in two of which treatment was successful. In Case 1, two errors were noted: the laryngologists were not called upon until trouble had arisen with the rubber airway tube, and trauma to the larynx resulted. In Case 2, there were the same two problems. In both cases earlier tracheotomy would have been the procedure of choice. In Case 3, based upon knowledge gained from the first two cases, the laryngologist was called immediately. The tube was removed before it could do any harm, yet it served a necessary and vital purpose. Tracheotomy was not required owing to improvement of the patient. Death was attributed to barbiturate poisoning with secondary pneumonia. The following conclusions were drawn from these observations: 1. A trained team of internist, anesthesiologist and laryngologist is required for prompt, proper, and adequate treatment of barbiturate poisoning and should see the patient together and immediately as in an emergency. 2. An immediate estimate of airway adequacy should be made, and if the airway is obstructed it must be cleared immediately. 3. If cough and swallow reflexes are absent and if the patient is unconscious and a long period of unconsciousness is anticipated, immediate tracheotomy is indicated. 4. If it appears that the patient may improve so that reflexes are evident in 8 to 10 hours, temporary intubation with an anesthesia tube, oxygen, and maintenance of airway are desirable, with reevaluation later by the medical team.

DISCUSSION

DR. HANS VON LEDEN: I should like to congratulate Dr. Lewy on his lucid description of the problem and to stress early tracheotomy, because I feel as he does that a stormy course of two or three days may often be avoided.

I wish to show a slide on another patient. This patient was brought to the emergency room with a diagnosis of carbon monoxide poisoning. He had been found in his garage at 10 a. m. with the motor of the car running. Artificial respiration was instituted, and the usual supportive measures were given. That evening it was learned that a bottle of barbiturates was missing and that the patient had been in the garage only a short time before he was discovered. He became progressively worse; by 10 p. m. the temperature was 106 F. and the pulse and respiration rates 160 and 62 respectively. He was in complete coma. The chest and throat were full of secretions which were aspirated almost constantly through an endotracheal tube, but there was a rapid flow of secretion, possibly due to irritation by the carbon monoxide gas. A tracheotomy was performed about 11 p. m., and the supportive measures were continued. It was then possible to aspirate secretions promptly and effectively and to supply the needed oxygen. The remainder of the course was entirely uneventful.

I should like to thank Dr. Lewy again for bringing out these important points and stress that early tracheotomy often means the difference between an easy and a stormy course.

DR. JOHN ELSEN: In addition to the advantage of tracheotomy mentioned by Dr. Lewy, the evaluation of the cough reflex is very easily made after tracheotomy. The cough reflex on stimulation of the tracheal mucosa is one of the last reflexes to disappear in severe barbiturate poisoning. The presence of the cough reflex is extremely important, whether or not tracheotomy is done. If the cough reflex is absent or inadequate, secretion will collect in the smaller branch bronchi and never be brought to the trachea or main bronchi where it can be aspirated.

With tracheotomy, the aspirating catheter can be inserted beyond the cannula and the activity of the cough reflex can be estimated easily. If there is little or no cough, there is danger of atelectasis, and the patient may drown in his own secretions. The dosage of picrotoxin can be altered according to the activity of the cough reflex.

DR. PAUL H. HOLINGER: Certainly the increasing use of tracheotomy for almost every disease warrants comment. Dr. Lewy has added an indication to the many diseases for which it is being used. Again we have to stress to our medical colleagues that tracheotomy is a safety valve. In the last two years we have brought this out with one disease after another—poliomyelitis, postoperative collapse, coma, true cerebral accidents, etc., and again the function of the anesthesiologist is brought out in the taking over of the management of these conditions to

the elimination of the otolaryngologist, in a field in which we think we have more or less priority and in which we feel we should be able to give the necessary treatment.

The use of an indwelling tube is a nonsurgical procedure; frequently it is desirable to use it to avoid surgical procedures, but Dr. Lewy has shown the damage that can occur. We have seen many times various complications from indwelling tracheal tubes. If the anesthesiologist inserts a tube, from then on the otologist should take over. Certainly, 12 hours is the maximum time the tube should be permitted to stay in, and after that time a tracheotomy should be performed.

I think Dr. Lewy's cases are extremely interesting. We might point out that in the third case, in which the otolaryngologist was called early, the patient was lost. I wonder why, after bronchoscopy, the tube was inserted and aspiration carried out.

We have become accustomed to using the silver tracheotomy tube almost to the exclusion of other means. However, small tracheal tubes which can be attached to a bag for respiration are much superior. The respirator, if necessary, can be handled more easily than with the silver tracheotomy tube that is used routinely.

DR. ROBERT B. LEWY: This discussion throws additional light on the subject. Both Dr. Sibbitt and I, who did part of the tracheotomies, were well aware of the fact that the third patient did not survive in spite of the fact that he was seen early by a laryngologist. I think the cause of this patient's death was independent of any airway obstruction as such. The question of clinical judgment must come into every case. I would defend not doing tracheotomy on this patient; in view of his condition and the presence of reflexes it was not indicated. His death was not due to drowning or obstruction. It was for that reason that this case was chosen to present; we were anxious to show that patients do not invariably require tracheotomy, and we think it would be a mistake to give that impression.

I could not agree more with Dr. Von Leden. He has simply emphasized the necessity in yet another condition for doing tracheotomy. We generally believe that picrotoxin is best, but even it can lead one astray.

Book Reviews

Les tumeurs malignes des voies aéro-digestives superieures. By J. Ducuing and L. Ducuing. Price 2,000 francs. Pp. 582. Masson & Cie, 120 Boulevard Saint-Germain, Paris, 6e, 1949.

This book is the work of the Cancer Center of Toulouse, France. It comprises five chapters, the first devoted to anatomy and physiology of the upper respiratory and digestive tracts, the second to pathology of the malignant tumors of these regions, the third to symptomatology and diagnosis, the fourth to general treatment of these malignant growths, and the fifth to study of different tumors according to the localization (nasopharynx; soft palate, tonsils and base of tongue, in the mesopharynx, and pyriform sinus, etc., in the hypopharynx).

An important chapter is devoted to roentgenology of the larynx, and current surgical procedures (thyrotomy, partial laryngectomy, hemilaryngectomy by Hautant and Tapia's method, total laryngectomy by Perier, Gluck and Tapia's method, laryngectomy in three stages by Portmann's method, pharyngectomy, and deep neck dissection for removal of involved lymph nodes) are described in detail. The irradiation therapy employed consisted in 2.5 or 10 mg. radium tubes or 1 to 2 mg. radium needles for contact therapy, as well as collars containing 10 mg. of radium elements and made of special paste (Columbia). For distant therapy, use was made of radium elements of 300 mg. to 5 gm. in unifocal or multifocal applications and x-ray therapy by Coutard's method in three modalities, the first an application of 500 r every third day for 15 to 18 days, the second 150 to 200 r once or twice daily for 4 to 6 weeks, and the third three gradually decreasing series of treatments. The method of Nielsen and Baclesse of small irradiation fields gradually diminishing in area (5 by 5 cm., then 3 by 3 cm.) was also employed. The following statistics obtained by the authors are reported:

1. Cancer of the nasopharynx: 65 patients of whom 2 were cured by x-ray treatment.

2. Cancer of the mesopharynx (soft palate, tonsils, base of the tongue): spinocellular epithelioma, 84 patients, 3 cured by x-ray or radium therapy; basocellular epithelioma, 14 patients, 2 cured by x-ray or radium therapy; intermediate epithelioma, 5 patients, none cured; mixed epithelioma, 2 patients, neither cured; atypical epithelioma, 17 patients, none cured; lymphosarcoma, 17 patients, 3 cured with x-ray and radium therapy; fibrosarcoma, 6 patients, 1 cured with x-ray and radium therapy; reticulosarcoma, 6 patients, 2 cured with x-ray and radium.

3. Cancer of the hypopharynx (pyriform sinus): spinocellular epitheliomas, 75 patients, 2 cured; basocellular epithelioma, 8 patients, 2 cured by irradiation therapy, and atypical epitheliomas, 25 patients, 2 cured by irradiation therapy.

4. Cancer of the larynx (all forms): 13 patients treated by surgical procedures alone, of whom 31% were cured; 160 patients treated by irradiation alone, of whom 5.6% were cured, and 6 patients treated by combination surgery-irradiation, of whom none were cured.

The Surgical Treatment of Facial Injuries. By Varaztad Hovhannes Kazanjian, M.D., D.M.D., Professor Emeritus of Plastic Surgery, Harvard University Medical School, and John Marquis Converse, M.D., Assistant Professor of Clinical Surgery (Plastic Surgery), New York University College of Medicine. Price, $10.00. Pp. 574, with 746 illustrations, bibliography, and index. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1949.

This is a Boston-New York book, since so much of the work represented in it was done in those cities. However, it is much more than that, for the authors Kazanjian and Converse have had vast experience in war work, which covers almost any kind of injury, burn, or disease that may be found anywhere. Hence, this volume is authoritative in the best sense. ". . . the text is limited to cases which we have treated personally . . . the emphasis is placed upon general principles rather than upon the detail of individual cases. . . ." The authors make no claim to

originality and bow humbly to their predecessors in plastic surgery. However, this may be regarded as ultra modesty, for in the very nature of things, every plastic-surgery patient presents individual problems which may differ from any that the surgeon has solved previously. There is no cut-and-dried formula for this kind of surgery, in spite of the "principles" which are, to be sure, of so great importance.

While surgery of face and jaws is always remarkable in the restoration of function as well as of "looks," it seems to this reviewer that those dreadful scars and deformities produced by burns require the greatest skill. In such cases one has to deal with nature's crude attempts to heal. The involved scar skin is of poor quality and cannot be used in repairs to any extent. New skin must be measured, dissected free, and brought to the débridement areas and sutured skilfully with an eye to an effective blood supply for healing by first intention, and there must be use of special techniques in after-care to prevent recurrences. These poor sufferers are held by the contractions of their own tissues as if in a vice. Only skilful use of "the knife" can bring release. This release occurs when "the knife" is wielded by such patient and persistent surgeons as these collaborators. Their work is precise and precious.

Nasal Sinuses: An Anatomic and Clinical Consideration. By O. E. Van Alyea, M.D., Associate Clinical Professor, Department of Laryngology, Rhinology, and Otology, University of Illinois College of Medicine, Chicago. Second edition. Price, $9. Pp. 345, with 143 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, Md., 1951.

The new edition appearing ten years after the appearance of the first edition mirrors the great strides that have been made in the considerations of the nasal sinuses. Progress is predominately evident in our increased knowledge of physiology, allergy, and the introduction of new antibiotics and other remedial agents. The subject matter is presented in the following chapter sequence: (1) histopathology, (2) nasal physiology, (3) acute nasal infection, (4) maxillary sinus, (5) frontal sinus, (6) ethmoid sinus, (7) sphenoid sinus, (8) sinus disease in children, (9) allergy, (10) tumors, (11) complications, (12) relation of sinuses to other conditions, and (13) general therapeutic measures. There is both a subject and an author index completing the book.

Otorhinologists and general practitioners will find the book of value in their everyday practice and the student will find it a basic source of knowledge and a valuable addition to his library because Van Alyea has such a rational and logical approach to his subject. The material is well written, the printing is good, and diagrams and illustrations supplement the text.

Year Book of Eye, Ear, Nose and Throat, 1950. Edited by Derrick Vail, M.D., D. Ophth. (Oxon.), F.A.C.S., Professor and Director, Department of Ophthalmology, Northwestern University Medical School, Chicago, and Samuel J. Crowe, M.D., Professor of Otology, Rhinology, and Laryngology, Johns Hopkins University School of Medicine, Baltimore, with the collaboration of Elmer W. Hagens, M.D., Chicago. Price, $5. Pp. 446, with 127 illustrations. The Year Book Publishers, Inc., 200 E. Illinois St., Chicago 11, Ill., 1951.

This new book presents an up-to-date review of the literature published between November, 1949, and October, 1950. Each aspect of the various phases of each specialty is adequately covered, and the subjects selected amply cover the entire range. Parenthetically, it may be noted, each of the editors has appended a special article emphasizing the progress which has been made during the past ten years. As always, the various summaries have been succinctly written and are all well organized. The busy specialist will find this volume a valuable addition to his library, and the student will find it an excellent source of reference and review.

Directory of Otolaryngological Societies *

INTERNATIONAL

PAN AMERICAN ASSOCIATION OF OTO-RHINO-LARYNGOLOGY AND BRONCHO-ESOPHAGOLOGY

Meeting: Third Pan-American Congress of Oto-Rhino-Laryngology and Broncho-Esophagology
Place: Habana, Cuba. Time: January, 1952.
President: Dr. José Gros. Information may be secured from Dr. Chevalier L. Jackson, 3401 N. Broad St., Philadelphia 40.

SECOND LATIN AMERICAN CONGRESS OF OTORHINOLARYNGOLOGY AND BRONCHOESOPHAGOLOGY

President: Prof. A. de Paula Santos.
Secretaries: Dr. José de Rezende Barbosa, Dr. Plinio de Mattos Barretto, Hospital das Clinicas, São Paulo, Brazil.
Place: São Paulo, Brazil.

NATIONAL

AMERICAN MEDICAL ASSOCIATION, SCIENTIFIC ASSEMBLY, SECTION ON LARYNGOLOGY, OTOLOGY AND RHINOLOGY

Chairman: Dr. Carl H. McCaskey, 20 N. Meridian St., Indianapolis.
Secretary: Dr. Sam H. Sanders, 1089 Madison Ave., Memphis 3.
Place: Chicago. Time: June 11-13, 1952.

AMERICAN ACADEMY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

President: Dr. Derrick Vail, 700 N. Michigan Avenue, Chicago 11.
Executive Secretary-Treasurer: Dr. William L. Benedict, 100-1st Ave. Bldg., Rochester, Minn.
Place: Palmer House, Chicago. Time: Oct. 14-20, 1951.

AMERICAN BOARD OF OTOLARYNGOLOGY

Secretary: Dr. Dean M. Lierle, University Hospitals, Iowa City.
Place: Palmer House, Chicago. Time: Oct. 9-12, 1951.
Place: Royal York Hotel, Toronto, Canada. Time: May 13-16, 1952.

AMERICAN BRONCHO-ESOPHAGOLOGICAL ASSOCIATION

President: Dr. Herman J. Moersch, Mayo Clinic, Rochester, Minn.
Secretary: Dr. Edwin N. Broyles, 1100 N. Charles St., Baltimore 1.

AMERICAN LARYNGOLOGICAL ASSOCIATION

President: Dr. H. Marshall Taylor, 111 W. Adams St., Jacksonville, Fla.
Secretary: Dr. Louis H. Clerf, 128 So. 10th St., Philadelphia 2.
Place: Royal York Hotel, Toronto, Canada. Time: May 23-24, 1952.

AMERICAN LARYNGOLOGICAL, RHINOLOGICAL AND OTOLOGICAL SOCIETY, INC.

President: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester, N. Y.
Secretary: Dr. C. Stewart Nash, 708 Medical Arts Bldg., Rochester 7, N. Y.
Place: Royal York Hotel, Toronto, Canada. Time: May 20-22, 1952.

SECTIONS:

Eastern.—Chairman: Dr. Francis W. Davison, Geisinger Memorial Hospital, Danville, Pa.
Place: Waldorf-Astoria, New York. Time: Jan. 11, 1952.
Southern.—Chairman: Dr. Lester A. Brown, 490 Peachtree St., Atlanta.
Place: Academy of Medicine, Atlanta. Time: Jan. 14, 1952.
Middle.—Chairman: Dr. Ralph J. McQuiston, 20 N. Meridian St., Indianapolis.
Place: Indianapolis Athletic Club, Indianapolis. Time: Jan. 28, 1952.
Western.—Chairman: Dr. Howard P. House, 1136 W. 6th St., Los Angeles.
Place: County Medical Building, Los Angeles. Time: Jan. 19-20, 1952.

AMERICAN OTOLOGICAL SOCIETY

President: Dr. Gordon D. Hoople, 1100 E. Genesee St., Syracuse, N. Y.
Secretary: Dr. John R. Lindsay, 950 E. 59th St., Chicago.
Place: Royal York Hotel, Toronto, Canada. Time: May 18-19, 1952.

AMERICAN OTORHINOLOGIC SOCIETY FOR THE ADVANCEMENT OF PLASTIC AND RECONSTRUCTIVE SURGERY, INC.

President: Dr. Norman N. Smith, 291 Whitney Ave., New Haven 11, Conn.
Secretary: Dr. Joseph G. Gilbert, 111 E. 61st St., New York 21.

AMERICAN SOCIETY OF OPHTHALMOLOGIC AND OTOLARYNGOLOGIC ALLERGY

President: Dr. William H. Evans, 24 Wick Ave., Youngstown 3, Ohio.
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* Secretaries of societies are requested to furnish the information necessary to keep this list up to date.

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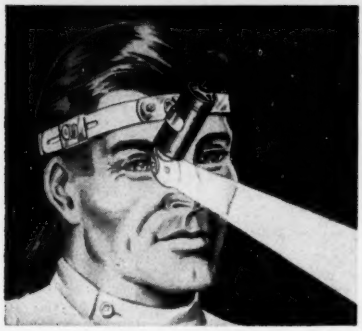

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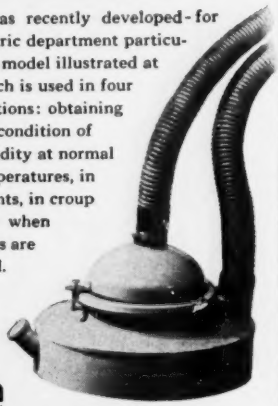

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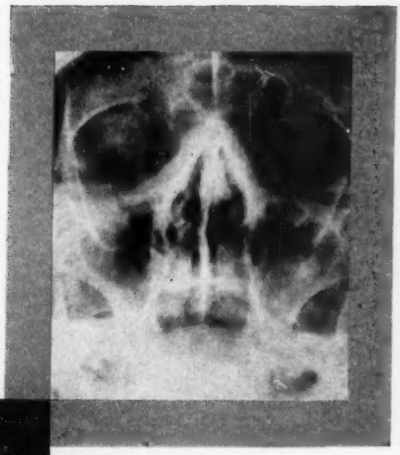

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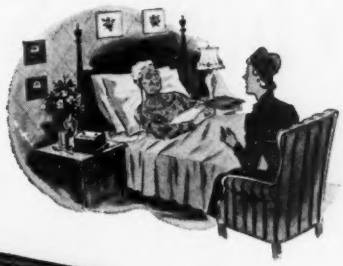

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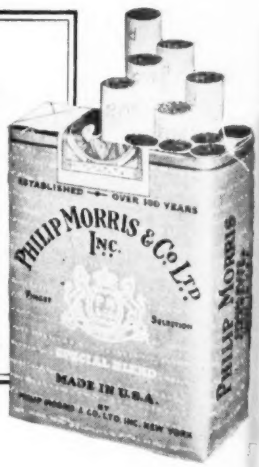

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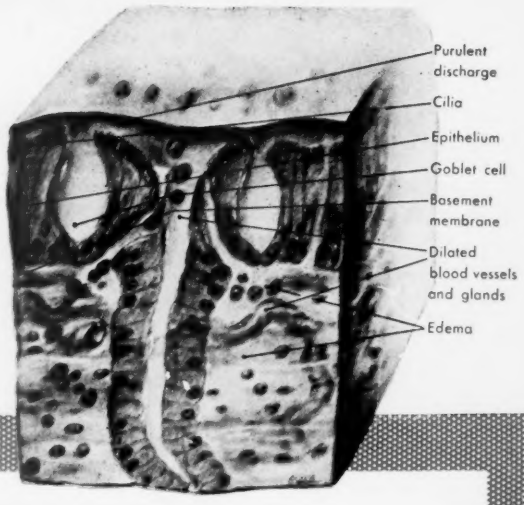

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1. Rehfuss, M. E., Albrecht, F. K., and Price, A. H.: A Course in Practical Therapeutics. Baltimore, Williams & Wilkins Co., 1948, p. 111.
2. Kelley, S. F.: In Cornell Conferences on Therapy. New York, Macmillan Co., 1947, Vol. 2, p. 156.
3. Gold, H.: In Cornell Conferences on Therapy. New York, Macmillan Co., 1947, Vol. 2, p. 151.

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